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Color Technique in Industry *

Faber Birren

THE use of color to prevent visual fatigue and increase the mental as well as eye comfort of workers is described by Mr. Birren.

COLOR in industry is a popular subject these days. Hardly anyone would venture to deny its value in aiding good visibility, safety, and human morale. The real problem, however, is less a matter of justifying color than it is of trying to use the head rather than the heart in planning its application.

For color is an emotional thing. There is real difficulty in letting an objective attitude hold the whip hand over purely personal likes and dislikes. All of us have a natural feeling for color. What we prefer is often confused with what we think others prefer and, therefore, should have. Opinions are likely to cloud purposes.

But emotion to the contrary, it is entirely possible to rationalize color without romancing it. For color, as related to factory production and safety, is a science before it is an art. It is not interior decoration in any sense of the word. Appearance is secondary and the mere by-product of a job intelligently done in relieving eyestrain, in minimizing hazards, in establishing ideal seeing conditions, in offsetting fatigue and in otherwise safeguarding the efficiency and well being of labor.

While the basic principles of color in industry may be clearly stated, perhaps the best way of explaining them is to discuss them in terms of actual use. Thus let me describe the specifications for an average factory, and in so doing illustrate how color is engineered to respect good scientific practice.

* This paper, as well as the following one, was presented at the session on Eye Protection, Greater New York Safety Conference, March 23, 1943, under chairmanship of Leonard M. Greenburg, M.D. A third paper, "Wartime Lighting and Safety," by Edwin Vennard, is published in the Edison Electric Institute *Bulletin*, April, 1943, and may be obtained upon request from the National Society for Prevention of Blindness.

"Use more light," says the illumination engineer.

"Make everything white," says the paint authority.

"Give them plenty of color," says the armchair philosopher, "to pep them up and make them happy."

To all of which I say, "Wait a minute!"

Assume, now, that Mary and John Balkan set out at seven in the morning for a defense plant in Bridgeport. A lot could be said about Mary and John, one inexperienced, the other experienced. They are good workers, both of them, and as prone to accident as the rest of us. Naturally enough their day will be spent seeing things with their eyes. And inasmuch as all things seen by the eye are colored, whether gray or red, much importance will be attached to their surroundings.

This is a competent factory. Yet management has had a difficult time with labor turnover and absenteeism and has done something about it with color. So Mary and John part ways at the time clock, to meet again at noon in the cafeteria.

Labor Relations and Morale

Every well-ordered factory should offer an interesting visual "change of pace" to the employee. Most work is monotonous. To use color to relieve emotional tension or fatigue, such spaces as corridors, stairways, washrooms, rest rooms, locker rooms, lunch rooms, should be treated differently from the rest of the plant.

Prescriptions.—Where no particular functions are to be served with reference to critical seeing, good color technique requires that the employee be satisfied with colors he will normally like best or which will establish an appropriate mood. Corridors and stairways in ivory or soft yellow are sunny, bright, and active in stimulation.

Due to the inherent likes of most men and women (as determined by research in color preference and the sale of consumer merchandise) blue is the best color for men's facilities, and soft rose for women's. In cafeterias, peach is the ideal color, being considered the most attractive of all light hues by the average person.

There may be a snicker or two at these remarks. Maybe so, but the management of any factory now beset by high rates of accident, absence, or distressing turnover, might advisedly think twice before taking the attitude that factories are no place for such niceties.

Remember, however, that I am talking about employee facilities, not working areas. And if such spaces are designed for the comfort and convenience of the employee, then it is good science and technique to make the most of them.

Safety is involved too. Where good color stimulates good housekeeping, where it helps to put the worker in an agreeable frame of mind, he naturally is more observant and careful—to say nothing of the fact that a well-designed rest room or washroom will definitely offset visual and emotional fatigue and thus return the employee to his job well rested and alert.

Mary Balkan operates a punch press. She goes from her rose locker room to department 12 of building 3. This is a great, vaulted interior, crowded with machines. Down well-marked aisles she proceeds to plant location 76.

General Factory Areas

Normally all ceilings, girders, and upper walls should be painted white to assure an ample flood of light from above. However, where the worker is placed in close proximity to a wall, this area should not be white. The adjustment of the human eye is regulated by the brightness existing in the general field of view. White walls may constrict the size of the opening of the pupil and hence reduce visibility of dark materials. In such an instance, the extra light gained by the high reflection of the white may be lost by the lowered efficiency of the eye. Also, the human eye is quick in adjusting itself to brightness and slow in adjusting itself to darkness. A white wall (which is meaningless) will thus hold advantage over fairly dark machines or dark materials (which are vital). And it may prove to be an annoying source of distraction and glare.

Prescriptions.—Hold wall tones which are in direct line of vision (up to approximately 8 feet from the floor) in pale hues having about 40 per cent reflectance. Keep such tones very soft and grayish, and preferably "cool" in quality. Remember that color is psychologically attractive. If made too rich or vivid, the attention may wander from the task. Employees may be very happy over colorful surroundings, but for the sake of proper efficiency, it is wise technique to let the environment be passive in order to avoid competition with the job.

Floors

Wherever practical, floors should be fairly light (with a reflectance of 25 per cent or better). Light floors, through multiple reflections, will accomplish much in increasing lighting efficiency, eliminating shadows, and effecting ideal seeing conditions which are devoid of excessive contrasts.

Machinery

Our Mary sits before a well-guarded punch press. Some time ago she nipped off the end of one of her fingers. But that was before the machine had been painted.

Colors for machinery should generally have a reflection value of from 25 to 40 per cent. Where metals such as steel are being worked or formed, colors too light should be avoided lest they: (a) pull the attention away from critical points, (b) produce glare sources, or (c) present unfavorable contrasts which introduce trying pupillary changes. Parry Moon writes: "Investigations of the most diverse kind show that a human being sees best and visual fatigue is reduced to a minimum when the entire field of view is approximately the same luminosity as that to which the fovea (center of the eye) is adapted."

This means that critical seeing demands a fairly uniform level of brightness on machines, walls, materials—all that occupies the field of view. Brightness (despite high light reflection) seldom affords a visual bed of roses. Luckiesh states: "In general, a brighter surrounding field reduces visual efficiency more than one which is darker than the central field."

Prescriptions.—Keep machine colors only *slightly* darker or lighter than materials. Let contrast be effected through hue rather than extreme lightness or extreme darkness. In other words, soft grayish tans will help build up sensitivity for the normally bluish cast of steel; soft grayish blue will heighten sensitivity for the orange cast of brass, etc. The seeing condition can be soft and uniform, and yet the product itself well dramatized and featured.

Shields and Backgrounds

Our Mary no longer looks down a black chute as she operates her punch press. This space is blanked off with a suitable shield

which (a) forms an ideal target, (b) provides contrast with materials behind the point of operation, (c) reflects more light at the critical part, (d) holds her eye to a uniform adjustment, (e) checks annoying shifts in accommodation from near to far, and (f) prevents motion behind the machine from distracting her attention.

High Visibility

Now for John's job. He drives a truck about the plant. His eyes are not concentrated on one thing all day long. He moves about, and if he doesn't watch himself he will run into pillars, knock people in the shins, and otherwise wreck miscellaneous havoc upon himself and others.

Unlike critical seeing tasks which demand prolonged concentration of the eyes in one restricted field of view (and where uniform brightness is essential), the more general safety measures of a plant call for extreme contrast and intensity of color. The marking of aisles, pillars, doorways, dead-ends, the identification of hazardous parts, moving objects, low beams, hot pipes, the regulation of traffic in crowded areas or down dim passageways—all these call for a more vigorous technique.

Most people in industry and safety are not aware of the fact that red (the traditional hue of danger) ranks pretty low in visibility. In fact, under very dim light, red is the first color to lose its identity and to melt away into nothingness.

Prescriptions.—Yellow is the color of highest visibility in the spectrum. Next in order is yellow-green, then orange, then red. While white holds its brightness under all lighting conditions, it lacks impulsive attraction to the eye and hence is not very compelling.

Good safety practice therefore will keep such functions and purposes as these in mind:

1. Yellow, being the most conspicuous of all colors, should be used where hazards are critical—off-and-on switches, danger zones, low beams, moving parts, etc. And if yellow is to be given real significance, it should not be used promiscuously lest it "cry wolf" in meaningless places and thus be disregarded where the "wolf" may actually lurk. Yellow may thus be No. 1 in a system of color for safety.

2. Yellow-green and orange, No. 2 and No. 3, may then be given other jobs to do—curbing, rails, boxes, cranes, trucks, etc. Order and significance may thus be intelligently worked out, with color employed for a specific rather than random impression on the worker. Yellow he watches with a wary eye; yellow-green he avoids somewhat gingerly; and orange he knows must merely be respected —for the dangers marked by each color have this relative importance.

3. Red may logically be reserved for fire apparatus, fire doors, exit signs, lines, etc. This acceptance is today universal and should no doubt be preserved.

Color system is thus meaningfully employed. Aisle marks keep traffic well regulated. Dado stripes at eye level guide employees down stairways and along corridors. White corners discourage littering. Red squares painted on the floor under fire extinguishers prevent obstruction. Alternate black and white stripes mark dead-ends, pillars, doorways. All these precautions have sense and reason to them. The worker is kept alert, his wandering moods arrested, his intelligence and instinct guided. And the plant, incidentally, looks very pretty.

Conclusion

So Mary and John meet at noon in the peach cafeteria. And that night they meet again, one from a rose locker room, the other from a blue, to walk down an ivory hued stairway. Weary, of course, but not too depressed over thoughts of tomorrow and the same thing all over again.

They perhaps do not realize it, but color has done much to make them the efficient and good workers they are and ought to be. They are workers free of all possible hazards. They are provided with a cheerful environment, free of monotony—for Mary, a "cool" working atmosphere, uniform in brightness, her machine individualized in its surroundings, her task well defined and visible; and for John, a safe plant with all its danger spots clearly indicated.

Both of them have relief from fatigue, a finer attitude, an inward pride.

Perhaps many accidents are due to carelessness. And maybe you can put your finger on this or that and say that color doesn't mean a thing. Yet color, intangible though it may seem, has a lot

of magic to it, like the "want of a nail." Surely abuse of the eyes may not be too remotely connected with the "header" a worker may take down a flight of stairs. A sick stomach (resulting in a day off) may be due less to a salami sandwich than to the struggle of trying to see under conditions of excessive contrast or glare. A lost finger or hand in a guarded or unguarded machine may, without too much imagination, be traced to a fatal indifference brought about by surroundings that might discourage any mortal of high or low forehead.

While many safety measures demand a necessary gadget or guard, discipline, training, education, rule or law, color has this to its great advantage—that all people love it and react to it without having to exert the least mental effort.

Discussion

QUESTION: When the walls are the same color or nearly the same as an aluminum wing being worked upon, is there any danger of the working surface being lost in the background?

MR. BIRREN: In a photograph it might be lost, but don't forget the eye sees a lot of things besides color. It sees things in terms of distance, in terms of space relationships. Many times when color plans are made this fact is forgotten. It is elemental that if you want to look for something which is white and you have the white in front of a black background, you may see it more easily. But if you were to look at it all day long, it would be excessively tiring.

I don't mind camouflaging a product in its environment. In fact, you have to camouflage where you are working with a colorless material. You rely on space relationships to have it stand out clearly. The thing that I think is often overlooked is that if you are working—and I think of a critical seeing test—at driving rivets into a plane's wing, there is absolutely no need of putting yellow marks around every hole to build up a strong seeing condition with contrast, simply because the man is concentrating all day long, eight hours a day, and you don't need brilliance in color. You only have to use strong contrasts—red and blue, and white and black—where you have to shock the worker into an attitude which he does not have, working at his task. In the case of the grayish walls and the aluminum wing, if there were a strong difference it would cause

the worker to look away from his job, particularly if he could look away at color. We rely on space relationships for him to know that the wing is there.

QUESTION: What effect is there from a man's constantly staring at blacked-out windows? What effect has that on a man who works mostly with aluminum and gray walls?

MR. BIRREN: It has a bad effect. Any excessive contrast in light and dark is very trying to the eye. But if you were to choose between an open and a blacked-out window, the blacked-out would be less a source of eyestrain than the open window. The worst trouble caused by blacked-out windows is that they generally decrease the amount of light in the factory which is not geared up to work without open windows. I have been in plants where the level of illumination was less than a half foot-candle because they blacked out all windows. Of course, eyestrain increases as the level of illumination decreases, particularly as you go down around three, two and one foot-candles.

So I would say the blacked-out window is not a source of eyestrain, but the lack of illumination is.

QUESTION: Of course, in the summertime the windows will all be open and the sunlight will be coming in. But we also have a very direct light from these fluorescent tubes which are set at a low level above our machines and are very numerous. Would there be any indirect effect on that?

MR. BIRREN: Certainly. If it is humanly possible to do so when blacking out those windows, paint them white or a light color on the inside of the plant.

QUESTION: As a physician—in the operating room we use that light green—I should like to hear a little more about the green. Of course, the yellow-green was mentioned, but we call this light green. How does that come into the picture?

MR. BIRREN: The painting of machinery in tan to build up the sensitivity of the eye to steel, and the use of blue to build up the sensitivity of the eye for brass and copper—these practices are taken directly from the development of blue-green in operating rooms, which was done some twenty or so years ago.

I happen to be somewhat familiar with this work. In fact, I did

a great deal of hospital planning just about fifteen years ago, when this blue-green operating room was being introduced.

Blue-green in an operating room serves two chief functions: first of all, it eliminates too much brightness over the walls—eliminates glare; and second, it provides a field of visual relaxation. The surgeon ordinarily is concentrating on a very small field of view and looking at a light intensity sometimes as high as a thousand foot-candles in the field of operation. Blue-green was established as a direct visual complement to the color of coagulated blood, so I am told. After the retina of the surgeon's eye had been tied to this red color, by looking at blue-green the sharpness of his vision is restored.

This, incidentally, is a good practice. It has been followed in industries working with specific colors. You can always work with complements. The big advantage of working with complements is that you do not have to rely for good visibility on light and dark contrasts. You can keep your brightness ranges pretty much the same and build your visibility up through color contrasts. The big advantage is that you do not need light and dark contrasts. These are the conditions which are hard on the eye. If there is any device you can follow to keep the brightness level the same and yet be able to see two different things with the aid of color, then you achieve an ideal result.

Incidentally, complements are very pleasing to the eye. People like them. Wherever you can use color with function or with a purpose in mind, people like it.

Behind the Scenes of a Successful Eye Safety Program*

A. G. Bungenstock

THE author presents practical suggestions for carrying on an eye safety program in industry.

THERE comes a time in every safety engineer's life when he realizes how inadequate his eye protection program is—when he goes through the shop and sees community goggles hanging on grinders, or when he gets a series of complaints that the glasses he has issued for protection are too heavy, they fog up, they hurt people's eyes, they are not sufficiently transparent, and so on through the entire gamut of complaints. And then he begins to wonder how effective his program really is—and so is born the resolve to do something about it.

First of all, the safety engineer has to determine the need for an eye protection program in his own plant. How many accidents occurred last year? Not how many eyes were lost, but how many potentially serious accidents were there? If there was only one, an eye protection program is needed.

I think it is wise to decide right at the start to do the job right. I should begin by surveying every job in the plant—and I mean *every* job. The safety engineer should look at the possibilities on each job of having a worker's eyes hurt, and then determine from these possibilities the types of protection that must be given.

Then he should chart that protection in very definite form. Some of the workers are going to need just the spectacle type of glasses. Incidentally, I like the term "safety glasses" better than "goggles." It is an added plug for safety. Other employees are going to need side-screen safety glasses. Of course, those working

* See footnote on page 3.

with acids are going to need acid safety glasses. Others will need cup-type safety glasses on their jobs. Every job should be charted, and beside the chart should be indicated the eye protection that is recommended.

Then, an oculist and an optician should work with the safety engineer. They should be brought into your plant, if possible, on a part-time basis if not on a full-time basis. There are very definite reasons for this. A certain percentage of prescription safety glasses will be required if the job is to be done right, and for that an oculist is needed. If he can do the eye examinations in the plant itself, a lot of time and money can be saved. After both the prescription and plano glasses have been obtained, an optician is needed to fit them. With all due respect to the storekeepers who hand out these glasses in most plants, they are not trained to do a good job. If safety glasses are comfortable, half the battle is won in getting people to wear them.

It is necessary to plan for adequate examination rooms, fitting rooms, and storerooms for spare parts and spare glasses.

The next step is to find out what eye accidents have cost during the past year. It is well to make a careful estimate of the cost of the new program. Then the idea must be sold to management. I don't think there should be much trouble in doing this if a logical, clear-cut, concise picture is presented of what the program is going to cost, and what it will save. It should not be very difficult to convince management that adequate eye protection is necessary.

The first step in setting up a program is to present in writing the charted safety needs of every job to every supervisor in the plant. If the facts are presented in writing, he cannot dodge the responsibility of seeing that the correct safety glasses are worn on each job, as indicated on the chart. Then rules should be set up for him. Four that have been used and found adequate are presented herewith:

Responsibility rests with the supervisor to:

1. Equip his employees with the necessary, authorized personal protective items
2. Instruct them in the proper use of such equipment
3. Require the wearing and use of protective equipment
4. Require that it be properly maintained, adjusted, and replaced when necessary.

Many people complain, "Well, I can't get the men to wear safety glasses." But isn't that just anticipating trouble? When there is a new job to be done in a plant, the layout men make a layout of the machines, the materials, and the processes that will be necessary for that particular job; the workers don't come in saying, "I don't think this job should be run this way; I don't think we should use this type of material." They accept the specifications drawn up by experts. Why cannot it be written into the specifications—along with the type of material and the process of the work—that for this particular job a certain type of eye protection is mandatory? Let it be assumed that the eye protection is part of the job layout. If it were approached from this angle, there would not be too much trouble.

The safety engineer has to do a selling job. After he gives the supervisor the chart and tells him what is required on the job, he has to sell him on the idea. He cannot just hand over the chart and say, "Here it is, Brother. They are going to wear them." He must tell the supervisor why he should be interested in the eye protection program. And once he is won over, 90 per cent of the problem is solved, because the supervisor can make or break the program. It will pay to give a lot of attention to the first-line supervisor.

Then there is the plant optician. Every time he fits a pair of glasses he can do a selling job for safety. He can tell the employee what the plant is doing to conserve his eyesight, and convince him that he should come back any time that his safety glasses need adjustment.

Employees must be taught to take care of their safety glasses. So many of them lay a pair of glasses down so that the lenses become scratched. After a few scratches appear, visibility is cut down to the extent of distracting the individual who wears them. The employee must learn to use his glasses correctly and not to abuse them. He must learn how to clean them.

The plant oculist also performs valuable service. Not only does he do the refraction but he does a retinoscopy, by which he can pick up many cases of the beginning stage of eye diseases. In this way he can advise the employee to consult his own doctor, and the condition is discovered in the early stages, before it becomes critical.

It stands to reason that work efficiency is increased when effort is made to improve the eyesight and safety of employees, through provision of prescription safety glasses.

"All this is costly and the cost might be prohibitive," is the fear expressed by management at times. Let me give you a few figures for the last two years, for the Western Electric Company. In the past two years we have issued about 3,700 pairs of prescription glasses and about 18,000 pairs of planos (regular safety glasses with no correction). In all, it adds up to almost 22,000 pairs of safety glasses, which, with the cost of the oculist and optician and a few minor expenses, have cost about $58,000. But for that same period of time I have on my desk 24 pairs of safety glasses in which the lenses are shattered. Every one of them undoubtedly saved an eye! (As a matter of fact, there must have been at least as many cases again in which the impact of the flying body might have been enough to blind an unprotected eye but was not enough to crack the safety lens, and these would not be brought to me.)

The normal compensation rate and all the attendant expense for the loss of an eye runs to about $3,000. At that rate, 24 eyes would have cost us $72,000. We spent $58,000. Purely from a profit-and-loss standpoint, we saved $14,000. But a more important consideration is that these 24 employees still have unimpaired vision. Their earning power has been preserved for the rest of their lives; they have been saved the intense mental and physical suffering attendant on the loss of an eye. It is no exaggeration to say that the administration of a good eye protection program will pay dividends beyond measure.

Discussion

CHAIRMAN GREENBURG: I am sure there are some questions for Mr. Bungenstock from an audience of this size and I am certain that a few of them are of the stereotyped nature: What do you do when a man complains about fogging? What do you do when they say the goggles are too heavy? What do you do when they say they are uncomfortable and don't fit? If there is anybody in the audience who has any real or fancied objection to the use of safety glasses, I think we ought to try to bring it out now and see what we can do to lay its ghost low.

QUESTION: The question I have in mind is in connection with the refitting of goggles. Suppose a man, after having a pair of goggles fitted, later decides that they are not right and wants them refitted. Would you suggest that he leave the work floor and go to the fitting room you spoke of, or would you suggest a patrol by the oculist equipped for emergency repair work of that nature?

MR. BUNGENSTOCK: By refitting you mean just a minor adjustment in the fit of the glasses themselves, not a change in refraction?

QUESTION: I mean adjustment of the glasses. For instance, the safety engineer, in his patrol of the plant, notices this man not wearing his goggles, and in conversation with him receives the excuse that the goggles do not fit. They fitted originally, yes, but they don't fit now.

In an instance such as that, would you suggest a patrol of the plant by the oculist or would you suggest that the worker take the time to go to the fitting room?

MR. BUNGENSTOCK: I would suggest that the worker take the time to come to the fitting room and let us fit him. We have found that this works out, unless the optician happens to be working in that vicinity fitting a group of new employees with plano lenses. Then he can stop and pick up this complaint and make the adjustment. Either way would work, but if you have a choice I would say let him come to the fitting room.

QUESTION: What if the complaint is just used as an excuse on the part of the employee to get away with not wearing goggles.

MR. BUNGENSTOCK: You can soon find out whether or not it is an excuse and do something about it then.

QUESTION: Do I understand that your company pays for the prescriptions of your employees?

MR. BUNGENSTOCK: That is right. We stand the entire cost.

QUESTION: I should like to ask a question concerning prescription glasses. Suppose we have 100 girls and ten of them wear prescription glasses anyway. We go to work and sell glasses to them. Do you suggest that we examine the eyes of the other ninety?

MR. BUNGENSTOCK: Not necessarily, unless they are complaining of some discomfort. If they have not worn glasses previously, I would not have them examined.

QUESTION: I should like to ask what number of employees do

you think there would have to be in order for it to be a paying proposition for a full-time optician.

MR. BUNGENSTOCK: Well, of course, you have a big job if you are just starting this program and you have not done it before. You have a big job fitting all the personnel at the beginning. But after you have gotten them fitted and you simply have to take care of new employees coming in, or replacements. Well, with eight to ten fittings of planos an hour, you can figure the amount of time you are going to need for an optician's service.

QUESTION: In the case of breaking a pair of prescription glasses which cannot be replaced for three or four days—then would the optician come in?

MR. BUNGENSTOCK: In that case the employee probably has a pair of his own glasses and we would let him wear those and put a pair of cover-alls over them until we can get him a pair of prescription safety glasses. We can get them pretty fast, thanks to the good services of optical companies.

QUESTION: Has the subject of adjusting prescription safety glasses to the working distance been considered? In general, the whole question of working distance has been very much overlooked in the matter of prescription glasses.

MR. BUNGENSTOCK: We have taken that into consideration and we use our oculist's advice. In some complicated cases we have had to go to trifocals where there were two different working distances on a particular job.

QUESTION: Do you think that it is necessary for the oculist to know something about the work that is being performed in order to make the proper fitting of prescriptions?

MR. BUNGENSTOCK: Very definitely.

SAME QUESTIONER: In other words, it would not do to send someone to an oculist just for prescription fitting unless the oculist knew something of the work?

MR. BUNGENSTOCK: The oculist should know whether it is a drill press job or what type of job the man is doing, and if he has any doubts, he will go out and look at the job and measure the working distances.

SAME QUESTIONER: That oculist, of course, would be the man in the shop. We are assuming that we are sending someone outside.

MR. BUNGENSTOCK: Then you can supply him with all the necessary details. Tell him what the working distances are.

SAME QUESTIONER: The type of prescription form that these various companies use does cover that, I imagine.

MR. BUNGENSTOCK: Yes.

QUESTION: Could you suggest one or two methods to persuade the employee that he needs goggles and that he should wear them?

MR. BUNGENSTOCK: What are you talking about now—a fellow who is on a job that requires the wearing of safety glasses and yet does not want to wear them?

SAME QUESTIONER: That is right.

MR. BUNGENSTOCK: Well, as I said before, I think your first attitude is the important one. If you convey to him the idea that you have set up the job a certain way, using a certain type of material, and say that on this job a certain type of eye protection will be worn—and if you say all this in a positive manner—you diminish the complaints by about 60 to 70 per cent right off the bat. You will get recalcitrant people who don't want to wear them. You will just have to go to work and sell each one individually on the idea. You can do that through a number of different approaches. You might, for instance, if he is a family man, appeal to the fact that he has no right to jeopardize the welfare of his family by taking a chance himself. If he has any youngsters and has planned for their education, he has made those plans on his present or increased earning power and he has no right to jeopardize them by an unsafe act. You can use any number of appeals. Get under his skin in some way and make him see that he is being selfish by refusing to be safe. You can sell him.

QUESTION: I can understand the need for individual glasses where a man is working on a certain operation all the time, but how about the situation in a small plant where one day you take two or three men to do, for instance, a chipping job on concrete and the next week you might take two or three entirely different men? Can the community goggles be used in a certain way to overcome that problem?

MR. BUNGENSTOCK: No, sir, I would never advocate the use of community safety goggles. Safety glasses are so cheap that you

can afford to equip every man in your plant with his own individual pair.

SAME QUESTIONER: Even though he may use them only once in a while?

MR. BUNGENSTOCK: Even if he uses them only one day a month, it is cheap insurance. A pair of plano glasses costs you about $1.50 and they will last indefinitely with proper care. You may have to replace a scratched lens and so forth. But for $1.50 you are saving a possible cost of $3,000 compensation, and that is cheap insurance.

SAME QUESTIONER: This idea of prescription glasses is new to me. Is it not possible to use the regular goggles in conjunction with the man's own glasses? How serious a proposition is that?

MR. BUNGENSTOCK: Well, I will tell you. Try it yourself sometime if you wear glasses. Put your regular glasses on and over them put a pair of cover-all glasses and wear them for eight hours and see how comfortable they are. I think you will be sold on the idea of prescription safety glasses.

QUESTION: Do you advocate 100 per cent use of safety glasses in the entire plant?

MR. BUNGENSTOCK: It may not be entirely necessary, although the trend seems to be that way. If you are honest in your analysis of jobs, and insist that you protect the men by the use of safety glasses wherever there is the slightest doubt, I think you will be all right. Of course, to play perfectly safe the thing to do would be to put them on every individual who comes into the plant.

QUESTION: How would you handle the problem of a man who has four or five different jobs in the course of a day and is exposed to different hazards on each job?

MR. BUNGENSTOCK: Do all of the jobs require the wearing of safety glasses?

SAME QUESTIONER: Yes.

MR. BUNGENSTOCK: Then give him a pair and let him use them on all of the jobs. Or don't I get your question? Was that what you had in mind?

SAME QUESTIONER: No, they might be different types of hazard. He might be welding for an hour or two and then he might go on a chipping job.

MR. BUNGENSTOCK: Then you will have to provide him with the type he needs on each job. It may mean giving him four or five pairs of safety glasses, but that is still cheap.

QUESTION: I should like to hear a little about safety glasses on men doing steam jobs.

MR. BUNGENSTOCK: Where you get a possibility of fogging?

SAME QUESTIONER: Yes.

MR. BUNGENSTOCK: There are certain chemicals on the market —antifog pencils—which do a very effective job for a period of one to three hours, even on the foggiest types of wash jobs and steam jobs, and I think you will find that if you will teach the men to renew that antifog compound at regular intervals, your glasses will stay free of fog.

QUESTION: Do you recommend safety glasses for office workers at any time?

MR. BUNGENSTOCK: No, we do not unless they happen to be engineers who go into the shop frequently and are exposed. Then when they go into the shop they must wear them.

QUESTION: How do you handle the fellow who habitually loses his glasses?

MR. BUNGENSTOCK: Make him pay for them.

QUESTION: Talking about prescription glasses, a lot of safety supervisors favor the clip-on type. What is your opinion?

MR. BUNGENSTOCK: I don't think you get the strength that you get from the regular type of safety glasses. You have a hardened lens but you also have a retaining ring or frame in which these lenses are set. The lenses may shatter, but they will be retained in the ring. You don't get that strength in a clip-on safety glass, and so I prefer to have them in a regular frame.

QUESTION: Do you feel that it is necessary for the company to buy the prescription glasses? In other words, the ordinary goggles are free—that is part of the setup—but prescription glasses belong to the individuals themselves and may be taken with them if they quit the job. Is that so?

MR. BUNGENSTOCK: If he wants to take them with him when he leaves we charge him a nominal sum, the equivalent of the cost of a pair of planos.

SAME QUESTIONER: There wouldn't be anything the matter with

having the men pay for them in the first instance. We could pay for the frame if they buy the lenses.

MR. BUNGENSTOCK: It is such a small matter. But you will get a better psychological attitude if you pay for them first. They don't cost much, and you will have a better chance of getting them worn.

QUESTION: How do safety shields for eyes compare with safety glasses?

MR. BUNGENSTOCK: They do a good job in lots of places where other parts of the face must be protected, but I would never use a safety shield as a substitute for glasses. I would use it sometimes in conjunction with glasses, but never as a substitute.

An Eye Health Program for Schools

PREPARED by members of the Society's staff, this article discusses briefly correct school environment, equipment, responsibility of personnel, and community co-operation in solving eye health problems of school children.

THE general objective of a school eye health program is to promote eye health and efficiency and to protect the eyes and the sight of pupils in elementary and high school in every way that lies within the scope of the functions of the school.

The health of the child is primarily the responsibility of the parents, but the school and the community must share that responsibility by making healthful living possible in all aspects of the child's life.

To be able to fulfill its obligations for eye health the school must have certain specific objectives in mind.

Correct School Environment for Eye Health

The first objective of a school eye health program is to provide a school environment in which all parts of the plant will contribute to the health, safety, efficiency, and comfort of the eyes of pupils, administrators, and teaching personnel.

Orientation of school buildings should be determined by climatic conditions, but buildings should be so constructed as to insure a maximum of daylight and absence of glare in every room. In addition, artificial illumination should be provided to supplement daylight on dark days and for general use in parts of the room not receiving adequate daylight illumination.

The amount of light should be determined by the visual task to be performed, the eye condition of those performing the tasks, and the length of time the visual effort is to be sustained. Although the amount of illumination is a somewhat individual matter, a

minimum is recommended under which no pupil should be expected to undertake work requiring close use of the eyes. *American Recommended Practice of School Lighting** sets this minimum at 15 foot-candles.† For prolonged or intensive eye work or for pupils with eye defects, increased illumination is necessary. Quality of illumination is quite as important as quantity. Light should be properly directed, diffused and distributed, and should be free from glare.

Quantity and quality of natural illumination depend on placement of windows, glass area, and control of light. It is desirable to have windows on one side of the room to the left of the pupils. Glass area should be at least 16 per cent, preferably more, of the floor area. The best light comes from the top of the window; hence it is essential for pupils seated on the far side of the room that the glass area should reach as near to the ceiling as possible.‡

Natural illumination should be controlled by shades that transmit diffused light. The most desirable arrangement is the placement of two buff or gray shades at each window, with rollers at the center, the space between being protected by a V-shaped bar. Shades should be wide enough to prevent streaks of light at the side.

The system of artificial illumination to be installed should be determined by a lighting expert. It should meet accepted requirements for quantity and quality, and should be adapted to the type of work carried on in each room. Classrooms, workshops, sewing rooms, laboratories, cafeterias, and gymnasiums may all require different types of illumination.

The decoration of rooms has a decided effect on quantity and quality of illumination. Clean white ceilings and light-colored walls reflect far more light than dark tones. Dull finishes should be used to prevent the possibility of glare.

* Illuminating Engineering Society and The American Institute of Architects, *American Recommended Practice of School Lighting.* New York, Illuminating Engineering Society, 1938.

† Foot-candle: unit of illumination; the direct illumination on a surface which is everywhere one foot from a uniform point source of one international candle. Inexpensive meters for testing quantity of illumination may be obtained from the General Electric Co., Nela Park, Cleveland, Ohio, and from the Weston Electrical Instrument Corporation, Newark, N. J.

‡ A check list may be obtained from the National Society for the Prevention of Blindness, 1790 Broadway, New York, N. Y.

In workshops it will be necessary for parts of the machines to be painted in contrasting colors to enable those working at them to identify such parts easily and to judge depth and distance.

Maintenance is an important factor in illumination. Accumulation of dust on windows, transoms, walls, ceilings and luminaires will cause a rapid decrease in the efficiency of even the most approved lighting system. Lamps deteriorate and should be replaced when their output is no longer sufficient to produce the amount of illumination decided upon for various places in the school building.

The school yard and playground should offer facilities for healthful, safe recreation and physical activities. Periodic inspection should be made of equipment used and any sharp-pointed or other dangerous objects should be removed.

Correct Equipment for School Eye Health

The second objective of a school eye health program is to provide equipment that will make possible a program of eye health, efficiency, and safety.

Seats and desks should be adjustable and movable and should be of a size and type that will provide for good posture. Desk tops that lift to an angle and are adjustable for distance are a great help in obtaining the best position of material in relation to eye use. Desks, tables, and chairs should be so arranged that no child faces the light or sits with his own shadow falling upon his work. If seats and desks are turned at a 30-degree angle away from the windows, the pupil will be spared glare from the sky.

Left-handed children should be so placed that the light will come over their right shoulder.

Workshops and laboratories should have protective devices on machines. Each pupil should be provided with goggles fitted to his needs; instructions should be given for their use and care, and provisions made for any necessary repairs.

Special attention should be given to printed and duplicated materials; these should meet the requirements of legibility that make for ease and comfort in seeing: clear type in black ink, on dull-finished white or light cream paper, with adequate spacing be-

tween words and lines, and adequate margins.* The size of type should be determined by the needs of the children. Young children require larger type than older pupils. For those under seven years of age, 24- to 30-point† type is recommended; for older children, a gradually decreasing size so that a pupil twelve years of age or over will have a 10-point type.

Chalkboards of slate, glass or composition material should be installed and be kept in condition. A chalk should be selected that will make heavy, clear lines, in a color that will give the greatest contrast. With slate, gray-green or blue-green boards, white chalk is preferable; with buff-colored boards, a dark blue.

Responsibility of School Personnel for Eye Health

The third objective of a school eye health program is to develop in all members of the school staff the desire and ability to accept their share of responsibility for the care and protection of the eyes of their pupils and of their own eyes.

A comprehensive school eye program must include every aspect of the school activity. In order to make such a program effective, each member of the school staff must participate. Administrators are responsible for providing correct physical and educational equipment. It is the responsibility of the teacher, with the supervision of the administrator, to see that everything so provided is used to the best advantage. In order to fulfill this obligation, every teacher should be familiar with the normal growth and development of the eye and the possible effect of any deviations from the normal on the health, education, and personality of the child. She must know how the normal eye functions to perceive the form of objects in the direct line of vision; how it adjusts for clear vision at various distances; the part that peripheral vision plays in giving an awareness of objects in the field of view; the importance of binocular vision in enabling the individual to judge distances and perceive three-dimensional form; and the significance of color vision and of the process of adaptation of the eyes to varying degrees of light.

* Luckiesh, Matthew, and Frank K. Moss, *Reading as a Visual Task*, New York. D. Van Nostrand Co., Inc., 1942. Chapters V–IX.

† Point: the unit of measurement of type size; there are 72 points to the inch.

She should learn to observe (and possibly to test) the individual child, to detect any indication that he may have limitations in any of these functions. She must also know which of the various visual functions are brought into play in each task or activity, and how a defect in any function may affect the child's ability to perform tasks expected of him. She can use to good advantage knowledge of how defects can be corrected or compensated for. Without such knowledge it is impossible for the teacher to appreciate the necessity of adapting educational procedures and materials to individual needs, and of arranging class activities so that no periods of work requiring close use of the eyes will directly follow one another; or to guide the child with uncorrectible visual defects into vocations in which his limitations will not prove a handicap or a hazard.

The teacher who has adequate knowledge of how the eyes function, an appreciation of the effect of visual defects or general health status of the child, and an understanding of the influence of illumination and other environmental factors, will be well equipped to impart the basic principles of eye health education to her pupils. Moreover, she will readily appreciate the importance of putting these into practice in school activities and of teaching the child to do likewise.

Children having serious eye difficulties will need special consideration.* Some school systems have established sight-saving classes for them, but where these are not available, special equipment should be provided and all work requiring close use of the eyes should be carried on in accordance with the recommendations of an eye physician.

Modern educational procedures depend largely on the use of sight. It is therefore necessary for all those concerned with the welfare of the child to know as early as possible what his eye condition is. Since eyes change with growth, periodic examinations are necessary throughout the school life. Ideally, every child should have a thorough medical examination, including an eye examination, before he enters school and at regular intervals thereafter. Since this is not always possible, various tests of visual functions are given by school physicians, nurses, or teachers. To be of value,

* Hathaway, Winifred, *Education and Health of the Partially Seeing Child*, New York, Columbia University Press. (In press.)

such tests must be correctly given and must be supplemented by observation on the part of the teacher of the reactions of the children during their daily activities.* The findings of such tests and observations should be interpreted to parents by the school health service in order that, where necessary, they may seek professional advice. The school health service also carries the major responsibility of assisting parents to secure such necessary advice and of helping them to follow any recommendations made. In order that the school health service may act intelligently, the department should be supplied with adequate records of medical examinations and of the recommendations made.† The most desirable results are obtained through the co-operation of the parents, the school health service, the teacher, the medical profession, and community agencies.

Community Co-operation in Solving Eye Health Problems of School Children

The fourth objective of a school eye health program is to interpret to the proper authorities and agencies eye health problems of the school in order that the best use may be made of what the community has to offer and that resources be made available if such do not exist.

Community agencies outside the school have responsibilities related to the eye health of school children that are not within the province of the school. The care of the eyes is a fundamental and an integral part of such a health program. Some eye difficulties are the result of venereal disease, tuberculosis, nutritional deficiency, or other general health difficulty, and prolonged treatment may be necessary. It is the responsibility of the school health service to help parents understand the need for this and to encourage continuance of treatment.

Sometimes when a child returns to school after a severe illness the physician recommends restriction of his physical activities. In cases in which the eyes have been affected, the restrictions

* Directions for giving vision tests and lists of observable behaviors may be obtained from the National Society for the Prevention of Blindness, 1790 Broadway, New York, N. Y.

† Sample record forms may be obtained from the National Society for the Prevention of Blindness.

may include a recommendation limiting the use of the eyes for close work. It becomes the school's responsibility to see that this recommendation is carried out. If a sight-saving class is available, the child may be placed in it as a temporary measure; in such a class he will have the advantage of a teacher prepared to understand his difficulties and to assist him in the best possible way. If a sight-saving class is not available, the school nurse or the school physician should interpret the needs of the child to the teacher of the regular grade.

Education of Parents and Children in Eye Health

The fifth objective of a school eye health program is to insure the ultimate goal of a school health program by educating parents and children to assume their responsibilities for eye health.

A health program should be continuous for the school life of the pupil. If the school authorities have fulfilled their obligation by providing a school building and school equipment best suited for eye health and efficiency, and if the teaching personnel has likewise fulfilled its obligation for making correct use of such provisions, the child, through his daily experiences, learns the principles of eye health, eye efficiency, and eye safety. But parental and community education must keep pace if results are to be accomplished. Since the social, economic, and psychological aspects of eye health and efficiency are as important as the educational, an understanding of these and an appreciation of their influence must be included in all programs planned for the child's welfare. Such appreciation and understanding may be engendered through visits of the parents to the school, discussion at parent-teacher meetings, and group and individual conferences with welfare organizations. Visits of the school personnel—nurses and teachers—to the home are important in developing confidence—confidence between the visitor and the parent, and between the parent and the school.

Opportunities for the Visually Handicapped Through Job Analysis*

Eileen Lester

SELECTING the job according to the capacity of the eyes is a somewhat new approach in industry, but a very practical one to apply, especially in seeking to increase manpower to meet war emergencies, according to Miss Lester.

THE military demands of war, with their grim realities, are rapidly emptying our great national reservoir of sound and sturdy men. What shall industries of all kinds do to get efficient replacements? That question has been presented to us for a reply and the answer is that if the employee is selected according to the requirements of the job, it does not matter whether he is physically impaired. How can this be done? By job analysis and by analysis of the qualifications of the employee. The abilities of the handicapped are gaining recognition because they are proving their worth.

Since the present discussion deals with the visually handicapped it is desirable to know what is meant by this term. The visually handicapped are those individuals who have limitations of a type or degree requiring careful selection of occupations to avoid those which are beyond their visual ability, or which might endanger their remaining sight, or which constitute an accident hazard to themselves or to their fellow workers. The group includes those individuals who have limited central visual acuity—by this is meant vision in the better eye after correction of between 20/200† and 20/70, making it difficult to recognize small details of form or

* Paper presented at the National Society for the Prevention of Blindness meeting at National Conference of Social Work, New York City, March 10, 1943.

† By 20/200 vision is meant that the individual sees at a 20-foot distance what the normal eye would see at a distance of 200 feet.

to work constantly under poor illumination. It also includes individuals with better than 20/70 vision but who have a pathological or progressive eye condition which may be made worse by certain types of activities or conditions of work.

It also includes a large group of individuals who have better than 20/70 central vision but who also have another limitation in visual function which constitutes a handicap or hazard in the performance of particular types of visual tasks. For example, an individual who has good distance vision but poor depth perception should not be allowed to operate a crane because that person would not have the ability to judge adequately the position of the objects viewed.

Although there are no accurate statistics regarding the total number of persons in this country who are visually handicapped, the few studies that have been done disclose a surprisingly high percentage of vision defects among the general population. A report made by the medical directors of college health services estimated that 15 to 25 per cent of the students entering colleges have serious visual defects. In the study of the health status of NYA youth, 20 per cent were found to need refraction. Of the first one million young men examined by Selective Service, 50,000 were rejected because of eye defects considered serious enough to limit their efficiency in modern warfare. Studies done by two industrial ophthalmologists reveal that among the average run of workers entering industry, one may expect to find approximately 15 per cent of them with serious vision defects which undoubtedly constitute a handicap to the individuals under certain conditions. A recent survey of 50 plants employing 167,000 workers found that 25 per cent of the employees have defective but correctible vision.

It is a common belief that modern industrial production depends on good vision but the problem is: "What is meant by good vision?" Many of the larger industrial concerns have made the Snellen visual acuity notation of 20/20 or 20/30 a prerequisite to pass the pre-employment vision examination and an individual failing to pass this eye test may be rejected from employment because of defective vision. Dr. Snell of Rochester pointed out in a paper* read at a meeting of the New York Society of Clinical Ophthalmology that

* Snell, Albert C., M.D., "The Need for a More Realistic Ophthalmic Service in Industry," *New York State Journal of Medicine*, Volume 42, No. 15, August 1, 1942.

an inflexible standard, acceptable for perception of visual acuteness, is often used in determining visual fitness for employment, but in the setting up of standards for all other physical functions, no such rigid, inflexible standard is used. All individuals do not possess an equal amount of physical strength, intelligence, or skill. It is a mistake to think of the process of seeing as a single function which can be evaluated by a single test. If we are going to evaluate the prospective employee's visual ability to perform a certain job, other visual functions in addition to acuity must be tested, because visual acuity for distance alone is not an adequate index of visual efficiency.

It is important that binocular vision, or the ability to use both eyes simultaneously to focus on the same object and to fuse the two images into a single image, be evaluated, since the individual uses this type of vision in many occupations. Another factor that is of vital importance in the performance of certain tasks is stereopsis, or the ability to judge distances. A one-eyed man lacks this ability and, in certain occupations, this might constitute a serious hazard to his fellow workmen. Another function that is of vital importance is muscle balance, or lack of it. Many young men who otherwise have been able to meet the high physical standards required of aviators have been eliminated because of this type of eye defect.

Another factor that should be considered before individuals are placed in jobs involving a high degree of color discrimination—as, for example, trainmen who must observe colored signals—is whether or not they are color-blind. In certain occupations peripheral vision or the ability to perceive objects in the area surrounding the direct line of vision is necessary and should be measured.

Dr. Kuhn, an ophthalmologist working in the industrial field, stresses the point that a modern program and technique of examining eyes in industry which is based on evaluating *visual acuity*, *depth perception*, *muscle balance*, and *color deficiency*, contributes a great advance in exactness of data regarding visual function.* The present routine of eye testing employed by most plants having a pre-employment vision examination, fails to disclose whether an

* Kuhn, Hedwig, M.D., "A New Concept of Visual Performance in Industry," THE SIGHT-SAVING REVIEW, Volume 10, No. 4, December, 1940.

individual possesses the visual qualifications necessary for the particular job to which he hopes to be assigned if employed.

All occupations do not require the same degree of visual function, and the important thing is to place the workman in a job which takes into consideration his visual ability. Job analysis is the most successful method through which detailed information about an occupation can be attained. It is used in industry to furnish employment departments with accurate data concerning the requirements of the job and the qualifications which the worker must possess to perform the job successfully. The analysis must outline the nature of the job, the exact duties to be performed, the mental and physical effort—including the degree and type of visual ability necessary to do the work—essential skills, and the working conditions involved in the job. It also covers hazards, wage scale, promotional opportunities, and any other factor that has a bearing upon the worker's ability to perform satisfactorily the duties of the job.

It is an encouraging sign that a few war industries have had job analyses made and, as a result, have created new opportunities for visually handicapped individuals who possess the qualifications considered essential for the job to be performed. Many of these new job opportunities require relatively simple types of training and when the visual abilities of the individual match the visual requirements of the job, a successful placement of the visually handicapped person will result, provided all other factors have been adequately considered.

The Occupational Analysis Section of the United States Employment Service has analyzed more than 70,000 jobs in war industries and the armed forces. Can't we hope that this agency will continue its contribution in the field of job analysis during the peacetime reconstruction period? Several examples of job analysis may help to demonstrate what is meant by selecting the worker for the job. Dr. Kuhn describes two employment situations in which certain visual qualifications are essential if the work is to be satisfactorily performed. For example, the overhead crane operator may have to drop a load of molten steel on an exact spot at an exact moment, 150 feet from where he pulls the levers. To do this with safety and efficiency, he has to have depth perception as well as good

central vision in each eye, and he cannot have a major defect of muscle balance. At the other extreme is a girl at a looping machine in a hosiery mill where her work has to be set a distance of 8 inches from her eyes. She must have perfect binocular co-ordination and ocular balance to sustain a sharp focus for an eight-hour working day. It is evident that neither of these jobs could be done by a person with a serious visual impairment. On the other hand, job analyses have shown that individuals working as unskilled outdoor laborers can often perform their tasks successfully even if they have vision as low as 20/100.

Other visually handicapped individuals have demonstrated their ability to be employed successfully as inspectors when their work involves the use of mechanical gauges or assorters, and as certain types of machinists, metalsmiths, and mechanics.

The following case illustration may be of interest:

A 20-year-old man was referred to the medical social worker in an eye clinic. The social worker learned that he was one of six boys; the other five were eligible for the draft or were working in defense plants. The patient had been called for selective service but was deferred because of his vision. His right eye was crossed and he had no vision in this eye because of long disuse. The young man wanted to aid the war effort and had applied for employment at a certain shipyard, but had not heard from the personnel office; and he felt certain that they did not want to hire him because of his eye condition. Surgery for cosmetic improvement was advised and after two operations the crossed eye was straightened and his appearance greatly improved. He again applied for employment at this same shipyard and although he had only light perception in his right eye (vision in his left eye was normal) he was placed successfully in a job which required certain skills that he possessed but which did not require binocular vision.

The value of the job analysis cannot be questioned. However, too few industries have done adequate analyses of the operations carried out within their plants and, as a result, do not know the visual requirements for certain jobs. The National Society for the Prevention of Blindness reports* in a survey which it made of 50 front rank industrial concerns, that more than 75 per cent of these plants make no effort to determine what visual requirements

* Tolman, Charles P., "Industrial Eye Efficiency in the War Program," THE SIGHT-SAVING REVIEW, Volume XII, No. 4, December, 1942.

are necessary or acceptable to qualify a worker for any particular job. The report goes on to say that this means "that these plants do not know how many color-blind or one-eyed men, or men with subnormal but correctible vision can be utilized." On the other hand, they may be employing men whose vision is a hazard on the particular job. Of these plants, 70 per cent make no test of the employee's vision; or if a test is made, it is inadequate to determine the essential factors of industrial vision.

Of equal importance—to quote further from the study—"The items related to industrial eyesight show that a relatively small number of the plants carry out adequate programs for saving sight. A still smaller number appear to understand or to follow those practices which would conserve sight and at the same time improve production, reduce spoilage, and regain skilled services from workers who have become handicapped by subnormal vision."

The evaluation of visual ability is primarily the responsibility of the ophthalmologist and it is important that he be consulted during the process of the job analysis and that he help to determine the visual requirements of the job.

Before placement of a visually handicapped individual can be considered, one must know not only how much, but what type of, vision the individual possesses, and how he or she can best use this vision with the minimum possibility of further loss. One of the principal difficulties facing the medical social worker, the vocational guidance and rehabilitation worker, or the placement agent, is the fact that although frequently an excellent medical report concerning the amount of vision, the eye diagnosis, and indicated treatment, is available, the report does not disclose what the individual can safely do with the amount and type of vision he or she possesses, and what working conditions, if any, should be avoided.

I wonder if we should not carefully review all the blanks that we use to obtain medical information in order to ascertain whether or not we make ourselves clear regarding what we must know about the individual's ability to do certain types of work, what things he can safely do, and what conditions of work would possibly jeopardize his eye condition and result in further loss of visual function. Too often, we merely put the full responsibility on the examining ophthalmologist and ask him to tell us what type of work

the individual should not do. Occasionally we receive the reply, "man able to do any type of work he can do with his remaining vision."

Ophthalmologists cannot always be expected to know the visual requirements of all the various occupations. This is also the responsibility of the social worker who is trying to help the visually handicapped person find suitable employment. We should be able to assist the doctor in his evaluation of the individual's visual ability by asking specific questions concerning certain activities or conditions of work which might be contraindicated. For example, we might include in our medical referral form such questions as whether it would be permissible for this particular man or woman to do work requiring the constant lifting of heavy objects, fine discrimination of detail, color perception, or work which must be done under either brilliant or poor illumination.

In closing, may I repeat three essential requirements that must be considered if we hope to utilize successfully individuals with varying types and degrees of vision? These are:

1. A careful analysis of the applicant's qualifications with particular attention being given to his assets, liabilities, and attitudes that will influence any job placement.
2. The visual and other requirements of various jobs—information which will be available only as a result of job analyses.
3. The actual placement of the individual solely on the basis of his qualifications.

Conservation of Sight*

C. Edith Kerby

THIS article presents the facts and factors in the prevention of blindness program, discussing prevalence and causes of blindness, measures for preventing blindness, and agencies and personnel concerned with the problem.

THE objective of a program for sight conservation is prevention of all types and degrees of visual handicap, as contrasted with the objective of the program for social treatment of the blind. The programs overlap, in certain areas, but without duplication; however, in many respects they are quite independent but co-ordinated instead with other related fields. For example, one aspect of the prevention program involves integration of eye protection services into the general programs of public health. The program in each field of activity requires the services of many types of professional workers.

Definitions of Blindness and Seriously Defective Vision

For practical purposes the term "blindness" is usually interpreted to refer to "economic blindness," which includes not only total absence of sight, but sufficient visual handicap to require reliance on the other senses for the ordinary activities of life. The definition most commonly accepted defines a blind person as one who, with eyeglass correction, has central visual acuity of 20/200 or less in the better eye, or one who has better than 20/200 central vision, but an equivalent handicap due to limitation of peripheral vision (usually to a diameter of 20° or less). This means that the person on the borderline of blindness can just recognize at a given distance detail

* Excerpted, with permission, from the article, "Blindness and Conservation of Sight," written jointly with Evelyn C. McKay, and published in the *Social Work Year Book, 1943.*

which a person with normal vision can see at ten times that distance. If the defect is in peripheral vision, his entire field of vision in the better eye would be less than the size of an ordinary book page at reading distance, and not much larger than the height of a tall man at a distance of 20 feet.

In addition, there is another important group of visually handicapped persons who are not blind, but partially seeing, which includes those having corrected visual acuity between 20/200 and 20/70, as well as those with less marked defects whose vision may grow progressively worse. Such persons carry on as sighted persons. Their chief needs are safeguards to conserve the remaining vision, and selection of educational media and vocations suited to the nature and degree of the individual handicap.

Prevalence of Blindness and Defective Vision

Existing census data on the number of the blind are incomplete and out of date. The best estimates available place the figure for the number of blind (as defined above) in the United States somewhere between 200,000 and 250,000, or approximately 1.5 to 2.0 per 1,000 of the general population. The number of partially seeing is probably higher. It has been found to be about 2 per 1,000 in the school-age group.

Moderate or slight degrees of deviation from normal vision are quite common in the population at all ages and all economic levels. Estimates of their prevalence by type and by degree are impractical, because experts find it difficult to define a "defect," inasmuch as the need for correction depends so largely upon the individual's tolerance of a minor defect.

Causes of Blindness

Study of the causes of blindness of our present blind population serves two purposes: It gives information regarding the nature, degree and underlying cause of blindness which is necessary in planning corrective medical care for the individual, if this is still possible, and provides data basic in development of adequate preventive services.

Having developed a Standard Classification of Causes of Blind-

ness,* the Committee on Statistics of the Blind inaugurated in 1933 a series of studies in which data are presented in cross-classification to show both the etiological factors and the type and site of eye affections. Information available to date covers approximately three-fourths of the blind of school age and a group of 20,000 adults in fifteen states and the Territory of Hawaii. Moreover, the Social Security Board is preparing for publication the results of a study of eye examination records in twenty of the states administering aid to the needy blind. This report, in which the Standard Classification of Causes of Blindness was used, should make a valuable contribution to our knowledge of causes of blindness of the adult blind. While these samples are not representative of the entire blind population, analysis of the findings of these studies indicates where emphasis must be placed.

A wide variety of etiological factors is responsible for existing blindness, the most important of which are communicable diseases, trauma, certain general systemic and deficiency diseases, hereditary and other prenatal factors, neoplasms and poisonings.

Information regarding etiological factors is lacking in a very large proportion of the total cases studied. These include types of affections, such as senile cataract, glaucoma and myopia, concerning which there is need for further medical research; also a large number of individual cases in which satisfactory study of the etiology either was not or could not be made.

The data on causes of blindness in children are more complete. Blindness in this age group, as shown in the reports of the Committee on Statistics of the Blind,† is due to communicable diseases, 24 per cent (chiefly ophthalmia neonatorum, 11 per cent; syphilis, 5 per cent; meningitis, 2 per cent); heredity, 13 per cent; prenatal factors the nature of which are unknown, 38 per cent; accidents, 8 per cent; neoplasms, 3 per cent; general diseases, 2 per cent; unknown, 12 per cent.

In early adult life, the causes are: communicable diseases (syphilis is responsible for about half of the cases; the trachoma rate, while very high in some states, is probably well under 5 per cent

* See "Manual on the Use of the Standard Classification of Causes of Blindness," Committee on Statistics of the Blind, 1940 (*infra cit.*).

† See "Eye Conditions Among Pupils in Schools for the Blind in the United States 1939–40" (*infra cit.*).

for the country as a whole); accidents, occupational and non-occupational; some early cataract and glaucoma of unknown etiology; and a small percentage of blindness due to poisonings, neoplasms, general diseases, and hereditary factors.

In mid-life, senile cataract, glaucoma, and general diseases (especially diabetes and vascular diseases) account for an increasing proportion of blindness. The total percentage due to communicable diseases is reduced slightly, except for syphilis, which remains high, and trachoma in affected areas. The incidence of trauma is much less than in younger age groups.

In old age, the cases of unknown etiology head the list, cataract probably accounting for about half the cases of blindness in this age group while the glaucoma rate, which remains the same as in middle life, is still important. Blindness due to general diseases (particularly vascular diseases) increases, while the proportion due to communicable diseases is reduced.

Special studies show that causes of eye difficulty among the partially seeing are similar in nature but somewhat different in distribution. In addition, there are many cases of refractive errors, chiefly high myopia, which cannot be corrected to normal with glasses or which are progressive in nature.

Prevention of Blindness

Mere listing of the underlying causes of blindness proves that the problems of prevention are manifold and that their solution involves a variety of methods and the co-operative efforts of many agencies and professional groups. Among the more important facilities and measures that might be mentioned are the following:

1. Measures for the control of communicable diseases are in the province of the health officer and his staff of public health nurses, laboratory technicians and others. Just as health authorities deserve the credit for reducing the incidence of blindness from smallpox almost to the vanishing point, so we are relying heavily on them to prevent blindness from the venereal diseases—syphilis and gonorrhea—by case finding, treatment and educational services and to publicize the efficacy of the new sulfa drugs in the prevention of blindness from trachoma and ophthalmia neonatorum.

2. Specifications for safety devices and the program for safety education to prevent injuries to the eyes are primarily the responsibility of safety engineers in industry and elsewhere. However, it is essential that they acquire some specialized knowledge of hazards to the eye.

3. For investigation of hereditary factors in blindness (both the general patterns of heredity and the facts concerning a particular family situation) the services of the geneticist may be required, but the application of this knowledge will usually depend upon a physician or social worker who has gained the confidence of individuals in the affected families.

4. All measures aimed at maintenance of general health and nutrition at a high level contribute to prevention of blindness and conservation of vision. Hence, the importance of health education programs, whether in official or voluntary agencies, cannot be stressed too much.

5. Inclusion in preventive health examinations of adequate techniques for the detection of eye defects and of follow-up to secure corrections is recognized as essential in the service required for all age groups. Whether this service shall be offered by the department or agency having primary responsibility for the group, or by another department through co-operative arrangements (as in the case of health department services within the schools), is immaterial, provided the plan is adequate and does not involve duplication of services.

6. For the complete examination and medical or surgical treatment required by individuals with eye conditions which might lead to blindness, ophthalmological service is needed. This may be provided in the eye service of a hospital outpatient department, or in the private offices of ophthalmologists. Whether paid for by the individual or an interested agency, it is important that the service be available within reasonable limits of space and time.

7. Measures which aim at the adjustment of general environment or visual tasks for greater comfort and efficiency in seeing are desirable. Notable examples of these are standards for adequate lighting in schools and industry, and special classes for education of the partially seeing school child (in which, by the use of ideal lighting, large-type books, reduced eye work, etc., education of the child is suited to his needs).

8. Legislation is a powerful weapon,* whether it makes mandatory desirable protective procedures (such as use of

* See "Mobilization of State Forces for Prevention of Blindness" (*infra cit.*).

prophylactics for ophthalmia neonatorum, premarital and prenatal examinations for venereal diseases, safety specifications), or authorizes establishment of necessary services in appropriate official agencies (for example, ophthalmological examinations and corrective treatment for those threatened with blindness, special educational facilities for the partially seeing).

Prevention of Blindness Agencies and Personnel

As we have seen, the various aspects of prevention of blindness can be effectively integrated into broad general programs of health, welfare, safety and education. However, there is need for a prevention of blindness agency as such, whose function is to stimulate and co-ordinate the activities of the various official departments and voluntary organizations. In a given state or community this may be the responsibility of either an official or a voluntary unit. Since the two types of agency function somewhat differently, there is a place for both, even within the same area, provided they co-operate rather than compete. Ordinarily the official bureau charged with responsibility for prevention of blindness will have its powers and duties limited by the legislation or budget under which it operates. Thus it is left to the private agency to discover additional needs, to demonstrate the value of new services, and to develop public opinion in support of all services.

Administrative responsibility for leadership in the state programs for prevention of blindness is delegated by law to official departments in forty states, although a few have only limited responsibility. Actually only 15 states have established programs under existing legislation. Some of these have budgetary, personnel, or organizational limitations. In addition there are four voluntary state agencies for prevention of blindness, as well as several effective local agencies. The chief national organization operating in this field is the National Society for the Prevention of Blindness, a voluntary agency. Several federal departments (for example, the United States Public Health Service and the Social Security Board) and voluntary national agencies, such as the National Safety Council, co-operate with the National Society in certain phases of the program.

The aim of the National Society for the Prevention of Blindness

is to give guidance to all types of agencies in any phase of the prevention program. Through its research, library and field services it endeavors to keep informed on the nature and extent of the problems and new developments in their solution. It stimulates public opinion in support of needed legislation and facilities. It helps to establish courses for the preparation of prevention of blindness workers (as in the training of sight-saving class teachers and supervisors, of medical social workers in eye services of hospitals, of directors in community programs for prevention of blindness, of health educators, and of public health nurses). Through educational materials, such as periodicals, pamphlets, films, exhibits, and vision-testing charts, as well as through advisory service and correspondence, it shares its knowledge of methods of conserving sight and preventing blindness with leaders in this field and with the general public.

Current Tendencies and the Effect of the War

There has been a marked growth in all types of organized activity in the field of prevention of blindness during the past few years, due in part to needs brought out by the Aid-to-Needy-Blind program of the Social Security Board, and in part to growing public appreciation of advantages and possibilities of prevention in all health matters. This tendency is intensified by the demands of the war situation for maximum manpower. Unfortunately, the war situation also tends to draw out of this field many trained workers and new workers who might otherwise seek special training for the service, and this is occurring just at a time when hazards to the eye are potentially greater. For example, safety workers are having to provide equipment and teach eye safety to millions of workers in new industries or processes under the handicap of tremendous speed-up. Similarly, public health authorities are hampered in controlling venereal diseases and trachoma by large-scale movements and concentrations of the population. On the other hand, because the war situation aggravates the problems, it may also highlight the need and give prevention of blindness a greater place in the war-time and post-war plans.

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The Forum

THIS section is reserved for brief or informal papers, discussions, questions and answers, and occasional pertinent quotations from other publications. We offer to publish letters or excerpts of general interest, assuming no responsibility for the opinions expressed therein. Individual questions are turned over to consultants in the particular field. Every communication must contain the writer's name and address, but these are omitted on request.

"Time Marches On" in Sight-Saving Classes

Do you find that occasionally some incident of your childhood, trivial perhaps in itself, has made such an impression upon you that it frequently bobs up before you? One picture of my school days frequently comes to mind. It is etched clearly on memory's page. I see the schoolroom, a rather large one with windows on two sides, equipped with old-fashioned wooden shutters —dirty, dingy walls, no artificial light. Desks were nailed down to the floor. They were not adjustable to size. If you were too small, your feet dangled. If you were too tall, your feet reached up under the desk of the pupil three seats ahead. Into this picture, in the midst of children most of whom were 11 and 12 years of age, steps a girl of 16, taller than the teacher, shy, always blushing over her conspicuousness, wearing very thick glasses, and stooping from constantly peering at things she can't see.

Kate always had to be in the front of the room, looking at the teacher's notebook. With this pressed against her nose she was able to read a little. The teacher was kind and had infinite patience. Doubtless we were not so kind and thoughtful—no better than countless generations of other children. I am sure we said and did plenty of things which hurt her cruelly. Before the end of the year, Kate became discouraged and left school, compelled to conclude her education at fifth-grade level. All the rest of us saw things quickly. Her mind was all right, but her eyes took lots of time for every single picture printed on the retina of her eye. Education moved along too fast. The struggle was too great. She had to quit, much as she wanted to go on. The title of this might be like the popular cartoon, "Born Thirty Years Too Soon."

So, in the words of the radio, "Time marches on." My next meeting with Kate was years later

when sight-saving classes were in the infancy of their development. The first sight-saving class in that community was being organized. One of the children to enter that class was Kate's first born, a girl six years old, born blind with cataracts. Medical science stepped in. The child had five operations before she was six years old and, with the aid of glasses, she was able to enter school—not to attend regular classes, but a sight-saving class.

The room was a large, pleasant classroom. The walls were painted a cheerful, light-reflecting cream color, with a matte surface. Strangely enough, this room was in the same building that provided the locale for the first picture I gave you. The desks were an innovation, at that time movable, so that children who could not see the blackboard well, could move their desks into any position that they wished. The books were printed in bold, black, 24-point type letters, upon dull cream paper. All the writing was large, with heavy, thick lines.

The room was artificially lighted by four outlets with totally indirect fixtures, each containing a 500-watt bulb. We had at that time what was considered an amazing amount of light—12 to 15 foot-candles on the work surface. The electrician who installed the lighting made the astounding statement that the teacher would be blind within a year. He was a poor prophet.

Kate's child graduated from high school two or three years ago. She finished at the normal age. Throughout her school life she did her written work in the sight-saving class, under the best conditions possible at that time, and under the intelligent care of a teacher trained in eye hygiene. All of her oral work was done in the regular classes with the so-called normal group. She had a good mind, but no better than her mother's. But her mother, having been born some years too soon, endured frustration and disappointment which her children have in a large measure been spared.

Kate has had five children, three with the same eye difficulty that she had. All of these children have been in sight-saving classes. They all moved along at a normal rate of promotion; the youngest is still enrolled. Those interested in eugenics can see many implications in this case, which I will leave to them. Time still marches on.

Some of our newest sight-saving classes have many improvements in equipment not possible for Kate's oldest child. Her youngest, however, may benefit by what additional knowledge time has given medical authorities, educators, psychologists, and psychiatrists, in helping her child to make a better adjustment and to keep a healthy mind in a healthy body. Last, but not least, her child may work under from 25 to 50 foot-candles of well-diffused artificial light—light which does not depend upon the illumi-

nating level becoming low enough to force itself upon the notice of a very busy teacher. The amount of light is automatically controlled. Kate's youngest may also benefit from other refinements of equipment and teaching technique.

When a child is placed in a sight-saving class, the problem is to educate him with the least possible eye- and nerve-strain, to teach him enough eye hygiene to enable him to care for his eyes properly, and to provide such vocational guidance as will be of assistance in choosing occupations which will not be injurious to his eyes.

There are, in general, two types of sight-saving classes in this country. First, the segregated type, which places partially seeing pupils in special rooms where they carry on their activities. Second, the co-operative type, which originated in Cleveland and is the most widely used throughout the country. This plan places the partially seeing child in a special room for work requiring the use of the eyes. For all other work, he joins the pupils of the regular grades.

The child spends part of the time in a regular classroom and part in the sight-saving classroom. The sight-saving classroom is his home-room. All work requiring the use of the eyes is done in the room especially equipped for him, and under the direction of the sight-saving class teacher, who knows the habits of eye use each child must form, and how much and what kind of eye work the eye physician has recommended for each child.

Oral work in which he may listen and participate is carried on in the regular grades. Thus he competes educationally and socially with the normally seeing group in his community, and learns to measure his own achievements in relation to those of others of his own group. This helps to prepare him for his later vocational life when he must have his work judged on the same basis as his fellow worker with normal sight.

It is also a distinct advantage to have covered the same day-to-day assignments as those in the regular grades in case the child's vision improves enough to return him to regular grade. The transfer may be made easily with a minimum of adjustment on his part. Thus, when a child with an eye defect is referred to a sight-saving class, as has been well said, "It is a room which has a door opening both ways," into a special class equipped with material to help him succeed educationally, and also into a regular class where he may evaluate his work in comparison with a larger group, and he continues as a part of the regular school group.

A classroom of standard size is selected which meets certain requirements as to floor space, window space, source of natural light, etc., as set up by the state department of education. The walls are

painted very light buff, and the ceilings, light cream. All painted or varnished surfaces are finished in a matte surface, to eliminate glare. The pupils' desks are movable and adjustable; the tops tilt and are adjustable for angle; and, in the newer desks, the tops are adjustable also for distance. This is a valuable aid in securing improved posture.

Large-type books printed in 24-point type, large maps, unglazed paper, large pencils and soft white chalk are some of the pupils' special tools. According to the grades represented in the room, it may be equipped with sand-tables, easels, typewriters with bulletin type, and special copyholders.

Sight-saving class pupils follow the curriculum of the school in which they are located. In the primary grades, since reading is a basic subject and must be gained from special books, the sight-saving class teacher is responsible for the teaching of all reading, spelling, writing, arithmetic, and eye hygiene.

In addition to the work done in the regular grade, sight-saving class pupils are taught the touch system of typing as a sight-saving aid. This has proved very helpful to students in senior high school and college.

Additional training in handwork and music is given. Eurythmics is found to give valuable contribution to the training of the child with defective sight who is shy, diffident, awkward, and has poor motor coordination. Handwork furnishes a period of eye rest from close work, such as reading, and develops skills and ideas which may be useful in making articles at home as a leisure-time occupation.

Radio lessons are proving a distinct educational aid for sight-saving class pupils, since the major emphasis is on learning through the ear.

"Time marches on!" Perhaps many years later Kate's youngest child may feel that he was "born thirty years too soon," for perhaps the world will have found more ways of preventing the occurrence of eye difficulties among children. To the hastening of that time all of us, educators, the medical profession, engineering groups, and the whole scientific world should dedicate our best efforts.

—OLIVE S. PECK
Supervisor, Braille and Sight-Saving Classes, Cleveland, Ohio

Ask Me Another—Sight Conservation*

Fill in each blank to make a true statement. Turn to page 54 to check your answers.

1. A medical practitioner who specializes in treating eye diseases and defects is known as an ..... or an .....

* Prepared by Eleanor W. Mumford, R.N., Associate for Nursing Activities, National Society for the Prevention of Blindness, and reprinted with permission from the *American Journal of Nursing*, April, 1943.

2. A non-medical practitioner who treats refractive errors and muscle defects without the aid of surgery or drugs is known as an .....

3. A person who grinds lenses, fits them into frames, and adjusts the frames to the wearer is known as an .....

4. Visual acuity of ..... is considered normal.

5. Accommodation is relaxed when the normal eye is fixed on an object at a distance of ..... feet or more.

6. Interstitial keratitis is an inflammatory disease of the cornea usually due to ....

7. An opacity of the crystalline lens is called a .....

8. The prophylactic solution considered most effective in the prevention of ophthalmia neonatorum is .....

Indicate by its letter which of the words or phrases following each sentence should be used to complete the sentence correctly.

9. Ophthalmia neonatorum is..... caused by a gonococcal infection.

(*a*) sometimes; (*b*) always.

10. About ..... per cent of the children in schools and classes for the blind are born blind.

(*a*) 10; (*b*) 90; (*c*) 40.

11. Light should be directed over the shoulder ..... the hand that is used.

(*a*) on the same side as; (*b*) opposite.

12. In childhood, ... is considered normal.

(*a*) myopia; (*b*) emmetropia; (*c*) hyperopia.

13. Patients with measles should .....

(*a*) have their *eyes* protected from bright lights; (*b*) be kept in a dark room.

14. Children ..... outgrow crossed eyes.

(*a*) usually; (*b*) seldom.

15. In glaucoma, central vision ..... remains good until the disease is well advanced.

(*a*) seldom; (*b*) often.

16. Blindness from glaucoma can ..... be prevented through early treatment and prolonged follow-up.

(*a*) often; (*b*) rarely.

17. Without good co-ordination of the two eyes, ... is usually faulty.

(*a*) color vision; (*b*) visual acuity; (*c*) depth perception.

18. The term "farsightedness" is used to indicate a condition in which .....

(*a*) one sees a greater distance than is normal; (*b*) one sees distant objects with less effort than is required for near vision.

19. Sympathetic ophthalmia is a disease which endangers the sight of the .....

(*a*) injured eye; (*b*) uninjured eye.

20. Convalescent patients should ..... encouraged to use their eyes for long periods of close work.

(*a*) not be; (*b*) be.

21. It is important to secure early ophthalmological treatment of strabismus to ..... and to .....

(*a*) prevent psychological difficulties; (*b*) prevent the necessity of wearing glasses; (*c*) save the sight of the non-fixing eye.

22. In the following list of symptoms and conditions, check those which indicate the need of *immediate* ophthalmological care:

1. Sudden decrease of vision
2. Watery eyes
3. Seeing more than one image
4. Halos around lights
5. Headaches
6. Changes in ability to distinguish colors
7. Sharp pain in the eyes
8. Appearance of dark areas in the normal field of vision
9. Itching lids
10. In children habitually holding book or similar visual material abnormally close to eyes
11. A foreign body embedded in the cornea
12. Burning sensation of the eyes
13. Twitching of the lids
14. Purulent discharge from the eyes
15. Hemorrhage in the bulbar conjunctiva
16. An injury which penetrates the globe
17. Styes

Eye Injuries in Childhood from Blasting Cap Accidents

Accidents to children from playing with blasting caps, many of which result in the loss of one or both eyes or impairment of vision, will be made the subject again this year of a vigorous campaign of education, in the hope of completely eliminating these tragedies. In the year 1942 there were 117 blasting cap accidents, involving 145 children. Of the children hurt, 36 lost the sight of one eye or both eyes, or their eyes were injured. These children ranged in age from five and six years to fifteen and sixteen.

The high percentage of eye injuries is due to the nature of a blasting cap explosion. The caps are small metal cylinders about one-quarter inch in diameter, and an inch or two long, closed at one end and loaded with a charge of sensitive and powerful explosive that is set off by a spark from a lighted fuse. Electric blasting caps have wires attached. These blasting caps are detonators used in firing high explosives and, as such, are vitally necessary in many types of work, including mining of all kinds, quarrying, road building, construction work, stump and ditch blasting, and other activities.

When these caps are exploded by children, they hurl fragments of metal in all directions and it is almost impossible for the boys and girls to escape injury. In addition,

the manner in which caps are tampered with leads to eye accidents. When children find them, their practice in a great many cases is to throw them into bonfires or try to light them with a match. The next most frequent cause of explosion is hammering them. Many of the children pick at the caps with a pin, knife, or nail. With the exception of when they throw the caps into bonfires, the children have the caps, in many instances, either in their hands or directly beneath their faces and, as a consequence, the pieces of metal hurled in all directions only too often find a target in the eyes. The list of such eye injuries is a long one and would fill pages. Some typical cases are cited below:

In Greenville, South Carolina, a fourteen-year-old girl had a blasting cap in her hands when it exploded. Flying fragments struck her in the eye. Near Minneapolis a talented high-school boy, a musician, suffered eye injuries when he touched a match to a blasting cap. Near Knoxville, Tennessee, a five-year-old boy was hit in the eye by flying fragments when his nine-year-old brother hit a cap with a piece of marble. At Post Falls, Idaho, the same story was repeated when a boy attempted to pry open a cap. An eleven-year-old boy at Flat River, Missouri, received fragments in both eyes as he hammered one with a rock. A five-year-old boy at Oxford, Ohio, found a blasting cap in the yard of his home where drilling had been done for a well. When it exploded, it so severely injured his right eye that it was necessary to have the eye removed. The other eye was also injured. One of the caps exploded almost in the face of an eleven-year-old boy at Park Ridge, New Jersey, threatening him with the loss of his left eye. At Greenwich, New York, a six-year-old boy lost his left eye when his elder brother struck a cap with a hammer. A five-year-old boy lost the sight of an eye in an accident at Arcadia, Wisconsin, when a playmate struck a blasting cap with a hammer.

In addition to the danger of blindness from such accidents, other types of injury received are especially painful and often render the victim incapable of useful work in later life. Fingers and sometimes hands are blown off, faces are disfigured, legs are mangled, and body injuries are also received.

The number of blasting cap accidents vary from year to year, but in recent years they have shown, on the whole, a decrease. In 1930 there were 327 children injured from playing with blasting caps. This number decreased to 292 in 1931. From then on, the statistics are as follows:

1932—171	children	injured
1933—198	"	"
1934—246	"	"
1935—235	"	"
1936—213	"	"
1937—165	"	"
1938—206	"	"
1939—195	"	"
1940—157	"	"
1941—132	"	"
1942—145	"	"

These figures are based on studies of newspaper and other clippings and on reports made by the Institute of Makers of Explosives.

About 68 per cent of the accidents noted take place in rural areas or in or near small towns. Large cities are comparatively free of them, although there have been cases where boys attending city schools have brought back blasting caps which they had found on week-end trips to the country.

The records of these accidents show that they begin to increase in the spring months and continue to mount until a peak is reached in July and August. After that, the number begins again to decline. This has been attributed to the fact that there is more open-air blasting during the spring and summer months and also to the fact that children play outdoors more frequently during these periods.

This is the seventeenth year of the educational campaign designed to prevent such accidents. Literature and posters warning against them, suitable for schools and other places, are issued by the Institute of Makers of Explosives, and are sent to any responsible persons on application. Schools in all parts of the country, government departments and bureaus, health organizations, safety societies, state mining and other divisions, automobile clubs, rural police, county agents, the National Society for the Prevention of Blindness, Boy and Girl Scouts, and other groups which have the welfare of children in their hands, are co-operating in the movement.

—F. J. BYRNE
Institute of Makers of Explosives, New York, N. Y.

Visual Acuity of College Students in Rocky Mountain State

The immediate importance of physical fitness in time of war serves to emphasize deviations from normal, particularly when they disqualify for military service. In the present war, visual defects rank high among the causes for rejection; for example, Rowntree[1] states that up to May 31, 1941, of 1,000,000 men rejected by the examining boards of Selective Service and the Army, 123,000 men were rejected because of eye defects. Only defects of the teeth ranked higher. Examination of University of Wyoming students has revealed an exceptional number with low visual acuity. In general, nearsightedness is probably the most common cause of low visual acuity in the college age group. Certain theories as to the etiology of nearsightedness held for a long time would lead one to expect comparatively little in a state such as Wyoming, where the population is sparse and use of the eyes for close work is not excessive. It is with the hope of stimulating further research into the causes of low visual acuity and possibly thus leading to prevention that the tabu-

lar data are presented in this discussion.

The Snellen test was given to the 1,549 entering students at the University of Wyoming (1939–1941). All of the students included are residents of the Rocky Mountain area, and most of them of the State of Wyoming. Examination of the table shows that 19.9 per cent of the men and 23.0 per cent of the women read finer print than the 20/20 line; of this number, a few read the 20/13 line, and one student, the 20/10 line. Of the remaining students, 32.7 per cent of the men, and 31.6 per cent of the women, had a visual acuity of 20/20; 47.4 per cent of the men and 45.4 per cent of the women had a visual acuity less than 20/20. If only the more severe defects are considered, 27.9 per cent of the entire group had a visual acuity of 20/50 or less, and 208 of these were disqualified for military service according to the original standard. The severe defect was bilateral in 63.5 per cent of those with a vision of 20/200 or less.

Statistics from many colleges are available. Two references are given for comparison. Kraehenbuehl[2] makes the general statement that approximately 31 per cent of the

VISUAL ACUITY OF 1,549 STUDENTS UPON ENTRANCE TO UNIVERSITY

Vision	*Men Without Glasses*		*Women Without Glasses*	
	Number	*Per Cent*	*Number*	*Per Cent*
$\frac{20}{15} - \frac{20}{10}$	157	19.9	175	23.0
$\frac{20}{20}$	258	32.7	240	31.6
$\frac{20}{30}$	171	21.6	58	7.7
$\frac{20}{40}$	24	3.0	33	4.3
$\frac{20}{50}$	30	3.8	39	5.2
$\frac{20}{70}$	28	3.5	54	7.1
$\frac{20}{100}$	30	3.8	44	5.8
$\frac{20}{200}$	70	8.9	59	7.8
Over $\frac{20}{200}$	22	2.8	57	7.5
Totals	790	100.0	759	100.0

youth of college age suffer from nearsightedness. Forty-six per cent of Wyoming students were unable to read the 20/20 line and are therefore potential sufferers. Boynton[3] reports a visual acuity of 20/50 or less in only 18.2 per cent of a group of 1,000 entering Minnesota students, as compared with 27.9 per cent of Wyoming students who had defects of this degree.

The causes of nearsightedness given in the literature are familiar. Close eye work has been considered an important factor by some authorities. Lindner[4] believes that close work, such as reading, which involves an intense metabolism of the retina, is the cause of trouble, rather than close work, such as watch repairing, where little movement is necessary. Certainly Wyoming youth are not given to excessive reading nor attendance at the movies, in comparison with other student groups. Both their work and recreation take them out of doors. If over-studiousness were general, inadequate lighting might be an important factor. Oil lamps are still used in many Wyoming homes. Of the 437 students questioned about it, over one-third had used them. As a matter of fact, defects were just as frequent in the group of students who had always used electric lights as in the other.

Eye defects are said to be more common among city dwellers.[5] There are approximately 2.3 persons per square mile in Wyoming and the population of the three largest towns is less than 20,000 each. Also fewer myopic eyes are said to be found at higher altitudes.[5] The altitudes in the most densely populated areas of Wyoming are between 5,000 and 9,000 feet; the lowest areas are between 3,000 and 4,000 feet.

Germans, Chinese, and Japanese are especially subject to myopia. Only about six per cent of Wyoming students have both parents of Japanese or German stock. Removing these from the group does not significantly alter the results. The accurate evaluation of heredity as a factor is impossible without actually contacting the parents. Students are too uncertain about details. All one can say after questioning them is that the wearing of glasses is somewhat more frequent among parents of those with defective vision.

Knapp[5] and others believe that disturbance in vitamin D-calcium-phosphorus metabolism is a cause of myopia. He reports improvement in myopic patients upon adding vitamin D and calcium to the diet. Wyoming differs from many states in these respects: It is a grazing state, fruits and vegetables are grown with difficulty, and there is a shortage of these foods in the average diet in comparison with agricultural areas. There is no reason for a shortage of meat and dairy products. General examination of Wyoming students reveals

little evidence of deficiency in any food element. Most of them are well built and in good physical condition. However, therapeutic trial of vitamin D and calcium might be profitable.

The causes usually given for nearsightedness, thus, are inadequate to explain its prevalence among these students. Myopia has been a frequent diagnosis in those who have had medical attention. Unfortunately, only 50 to 60 per cent have ever seen an ophthalmologist. The others have consulted optometrists or even travelling spectacle agents. The reasons are the scarcity of ophthalmologists in the state and the use of the title *doctor* by non-medical men.

In summary, visual acuity tests on 1,549 University of Wyoming students by means of the use of the Snellen chart[5] reveals an exceptional number of cases of low visual acuity in comparison with other student groups. Ophthalmological examination is needed to determine whether myopic or other changes are responsible, and to discover whether altitude, diet, or other factors are bringing about these changes. Such a study might contribute much to the efficiency and happiness of large numbers of people.

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Laramie, Iowa

Answers to "Ask Me Another" Questions

The questions are on page 47

1. Ophthalmologist, oculist
2. Optometrist
3. Optician
4. 20/20
5. 20
6. Prenatal syphilis
7. Cataract
8. Silver nitrate
9. (*a*)
10. (*c*)
11. (*b*)
12. (*c*)
13. (*a*)
14. (*b*)
15. (*b*)
16. (*a*)
17. (*c*)
18. (*b*)
19. (*b*)
20. (*a*)
21. (*a*); (*c*)
22. (*1*); (*3*); (*4*); (*6*); (*7*); (*8*); (*11*); (*14*); (*16*)

Note and Comment

Summer Courses for Teachers and Supervisors of Sight-Saving Classes.—The National Society for the Prevention of Blindness has been notified that the following universities and colleges will offer summer courses for the preparation of supervisors, teachers, nurses, and others concerned with the education and health of partially seeing children. Elementary courses will be given at Wayne University, Detroit, Michigan, June 21–July 30—registration should be made two weeks in advance; at Michigan State Normal College, Ypsilanti, Michigan, June 21–July 30; and at Teachers College, Columbia University, New York, N. Y., July 6–August 13, registration July 1, 2, and 5. An advanced course will be given at Wayne University, Detroit, Michigan, June 21–July 30, for which registration should be made by June 7. For a complete announcement of the courses, apply to the universities.

Test Eliminates Soldiers Dangerous in Night Operations.—Many factors other than age can influence rate of dark adaptation and effectiveness of night vision, says Major B. W. Rycroft, Royal Army Medical Corps, but as a general rule soldiers over thirty years of age are found to achieve less efficient night vision than their younger fellows. Intelligence was one of the factors observed to influence the results of night vision tests. The more intelligent types of men—officers, men in headquarters companies—came through Major Rycroft's test with greater success than less well-educated and less responsible men. Defective day vision, especially myopia, corneal nebulae, familial defects, and other ocular diseases, produced under-average results. Unknown factors, which include possibly steamy goggles, fatigue, or malingering, were behind others of the failures.

The investigation, described in a recent issue of the *British Medical Journal*, was and is being carried out among troops in the British Isles. Upon completion of the testing of a unit, recommendations are made to unit commanders with a view to increasing the efficiency of night operations. The information submitted by

the examining physician consists of: (1) The general state of night vision in the unit as a whole and also in comparison with other similar units. (2) The names of personnel whose night vision is above average and who are especially fitted for night patrols, night leadership, night "spotters," etc. (3) Picked drivers whose night vision is above average and who may safely be trusted to lead a column of vehicles at night in total darkness without lights. (4) Drivers who are night-vision-defective and dangerous in their present military occupations. (5) An opinion on the general ophthalmic state, *e.g.*, what percentage should be sent for routine examination.

A portable test apparatus is used, which 10,000 cases have shown to fulfill the criteria of being simple, robust, and "productive of uniform and standard results." The apparatus consists of five translucent screens, arranged as an irregular pentagon around a small bulb. On each of the five screens is a large V, mounted in five different positions. The lamp in the center is at varying distances from each; and the whole apparatus can be rotated so as to bring one screen at a time in front of the patient. Two hundred men daily may be tested with this apparatus.

In one unit it was afterward found that two of the men who failed the test were drivers who had already had minor accidents at night. Major Rycroft adds: "Failures must be repeatedly tested before being condemned, and change of occupation recommended only when the soldier himself, having a lack of confidence at night, has failed on the test and holds a responsible position. It is not difficult as a rule to detect the malingerer: the test is completely new and unfamiliar to him."

Society Publishes News of Activities.—Early in 1943, the Society began publication of its *Eye Health & Safety News*, which will appear every few months. It is informal in presentation, containing items of interest on current prevention of blindness activities, and is planned especially to serve those working in some field of sight conservation. It contains items of interest hitherto appearing in the Society's two professional bulletins, *The Sight-Saving Class Exchange* and *Medical Social Workers in Eye Services News*, which have been discontinued in the interest of economy. Much of the material which appeared previously in the *Exchange* will also appear in the REVIEW or in *The Journal of Exceptional Children*.

Members and friends of the Society were asked to indicate whether they wish to receive the publication regularly, and hundreds of requests have already been received. After the next issue, the *News* will be sent automatically only to those who have sent in written word asking for it. REVIEW readers are invited to send in their requests and any news items of interest.

News of State Activities.—With the advent of the Society's *Eye Health & Safety News*, the REVIEW is discontinuing its section on News of State Activities; henceforth these items will appear, when reported, in the *News*.

Eye Health of NYA Youth.—A recent report of the health status of young people coming under the National Youth Administration contains an interesting analysis of the visual findings. In this study 146,562 young people ranging in age from 16 to 24 years were given Snellen tests. The group include both white and negro youths of both sexes. Color vision tests are reported for 144,538. The presence of external eye diseases or symptoms was noted in 7,685. This included 1,977 cases of strabismus.

Only the high lights of this report can be presented here. For detailed statistics the reader is referred to the original report.

Sixty-four per cent had a normal vision (20/20) in both eyes, while 86 per cent had at least 20/40 in the poorer eye; 7.8 per cent had 20/100 in at least one eye and 5.0 per cent had 20/200; 4.8 per cent had 20/70 or worse in both eyes, and 1.9 per cent had 20/200 or worse in both.

The percentage with less than 20/20 was somewhat lower in the negroes than in the whites, and they tended to have fewer serious defects. In both negro and white the percentage with less than 20/20 in the better eye was somewhat higher in females than in males. The northern regions revealed relatively more with defects than the southern. All visual acuity findings were made without glasses. Chart or general room lighting is not mentioned.

The color vision tests were made chiefly with the Holmgren yarn and the Ishihara. The latter was given to 31 per cent of the group and the former to 63 per cent, and 5 per cent were given both or some not specified test. The findings from the two tests varied markedly. The Ishihara revealed impaired color vision in 5.2 per

cent of white males while the yarn test showed only 1.5 per cent. In white females, Ishihara indicated defective color vision in 1.2 per cent and the Holmgren 0.2 per cent. The negro findings with Ishihara were 3.5 per cent of the males and 1.4 per cent of the females. Exclusive of one region where the results were so far out of keeping with other areas as to cast doubt on their reliability, the Holmgren indicated color impairment in 2.1 per cent of the male negroes and 0.9 per cent in the females.

Eye diseases or symptoms noted ranged from 4.3 per cent in the East South Central region to 7.1 per cent in the Pacific area. Northern and Western regions were higher than Southern, although New England was remarkably low. These conditions included blepharitis, conjunctivitis, strabismus, trachoma, pterygium and nystagmus. It is to be noted that no intraocular diseases are listed. Apparently no facilities were provided for discovering or diagnosing these conditions, although they undoubtedly are the cause of some of the cases of lowered visual acuity.

Eye Trouble Among Needleworkers.—When 3,300 corset workers (Local 32, International Ladies Garment Workers Union) were offered free eye examinations and eyeglasses, only 190 took advantage of the offer. Very few workers applied for examination unless they had worn eyeglasses previously or had some subjective symptoms of eye trouble. Of the group examined, 45 per cent wore glasses and of these no more than one-half had had their vision tested within the past three years. Only 27 per cent of the last group had lenses which gave adequate correction. Myopia, hyperopia, astigmatism, presbyopia, conjunctivitis, eye muscle strain, and other conditions were found; astigmatism was the most common, appearing in 54 instances.

English War-Blinded Civilians.—In January, 1943, one hundred civilians in Britain were known by the National Institute for the Blind to have lost their vision as a result of enemy action. This figure does not include eyesight casualties in the civil defense services.

Red Army Has Way of Speeding Dark Adaptation.—Soviet physiologists now possess methods which infallibly secure maximum adaptation of the human eye to darkness within five or six minutes

after passing from light to darkness, Krikor Kekcheyev, Nikolai Derzhavin and Sergei Pilipchuk of Moscow declare in a recent issue of *War Medicine*.

In their cabled article, the three scientists say that "An important problem in war is that of expediting the period of adaptation of the eye in passing from light to darkness. Until recently only one method of shortening this period was known: If before passing into darkness a person was kept in weak, instead of bright, light, it was possible to reduce the period of adaptation from forty-five or fifty minutes to twenty-five or thirty minutes. Soviet physiologists now possess methods which infallibly secure maximum sensitivity not within half an hour but within five or six minutes after passage from light to darkness."

Although the method is not described by the three authors, apparently it includes weak excitations of the organs of sense of hearing, taste or smell, which, they say, thereby increases the sensitivity of other sense organs, such as the eye. They say it also has been found that the stomach, intestine and bladder should not be too full if good night vision is to be obtained, and that it has been demonstrated that changes in the sensitivity of night vision could be obtained by conditioned reflexes (subconscious habits).

The three scientists point out that—"The present war has revealed the immense and formerly inadequately appreciated importance of night battle and reconnaissance operations and hence the equal importance of night vision. . . . What aspects of the physiology of night vision interest military men first and foremost? One of them is the problem of increasing the sensitivity of the eye in the dark. In principle, increasing the sensitivity of night vision does not present any difficulty. In fact, Soviet physiologists in past years have published a number of works on the mechanism of changes in the sensitivity of human sense organs. It was found that excitation of any one sense organ by a customary and adequate stimulus immediately causes a change in the sensitivity of other sense organs, either heightening it or diminishing it. Academician L. Orbeli called this phenomenon interaction of afferent systems. It was soon established that weak excitations of the organs of sense of hearing, taste or smell enhance the sensitivity of other sense organs, including those of sight, whereas strong excitations have the opposite effect.

"The action of such stimuli on the thresholds of night vision proved to be prolonged, and it sometimes requires one and a half hours before the sensitivity of an eye adapted to darkness returns to normal. Further, it was discovered that the sensitivity of night vision is one of the most fluctuating functions of the human organism, but that it is 'possible, by selecting suitable stimuli for other sense organs, sometimes to increase the sensitivity of an eye already adapted to darkness to maximum by another 40 to 50 per cent.' The importance of increased sensitivity of vision in night reconnaissance and battle operations scarcely requires stressing. It is a matter in which every sentry scout, every infantry, artillery or naval observer and every night pilot is interested.

"In the course of investigating this problem several highly interesting details were revealed. . . . It is now clear that the sensitivity of human sense organs is directly dependent on the state of fulness of the stomach, the intestine and the bladder. Hence, it is important in responsible reconnaissance operations that the visceral organs of the abdomen and the pelvis should not be overcongested. Other factors tending to diminish the sensitivity of the eye adapted to darkness (such as fatigue) were also ascertained and studied.

"In 1936 and 1937 there appeared almost simultaneously three reports on research . . . demonstrating that changes in the sensitivity of night vision could be obtained by conditioned reflexes. The weak and undifferentiable sound of a metronome or a tuning fork, it was found, may evoke great changes if it is combined several times with active factors, for example, with taste, cold or sound stimuli. What Academician Pavlov demonstrated for secretory reactions (salivary gland) can now be extended to the mechanism of change in the sensitivity of sense organs. This is explained by the fact that the change is produced by the sympathetic nervous system. . . ."

Illinois Vision Testing Project.—Since 1936, 1,466,510 school children in Illinois have had their vision tested under a project co-sponsored by the Illinois Society for the Prevention of Blindness and the WPA. Over 77,000 children were found to have defective vision, and of these, nearly 53,000 had their vision corrected. With

the assistance of Chicago ophthalmologists, workers were given a course which included anatomy and diseases of the eye, refractive errors, squint, public relations with the schools, and vision testing procedures. The workers were trained to give the regular Snellen chart examination.

Report on the work was presented at the meeting of the Illinois Medical Society in May, 1942. The Illinois Society for the Prevention of Blindness has demonstrated beyond doubt the feasibility of a project such as this; however, the large-scale collaboration of the WPA is, of course, no longer possible due to the enormous cuts this agency has taken with the rising curve of employment.

"Eyes for Service."—Under this title the Society has issued its 28th Annual Report, for the year 1942. Because of the need for wartime economy the Society is not extending the circulation of the Report as widely as in previous years, but single copies may be obtained upon request.

William Fellowes Morgan, 1860-1943.—We report with sorrow the death of the Society's President Emeritus, William Fellowes Morgan, on May 7, 1943. Mr. Morgan was the first President of the national organization and served in this capacity from 1916 until his retirement in 1940. His leadership throughout this quarter of a century was a notable factor in the development of the prevention of blindness movement, which was unusually fortunate in having the invaluable guidance of one experienced in administrative, financial, and legislative fields. With his death the Society has lost an old and devoted friend and sponsor.

Augustine J. Smith, 1868-1943.—The Society is also grieved to report the death of Augustine J. Smith, a member of its Board of Directors, who served faithfully for some years. Mr. Smith's interest in preventing blindness and conserving vision grew out of his activities on behalf of the blind. He was their warm friend and participated in the councils of various organizations dedicated to their welfare. Because of his understanding of their needs, he gave much of his time and energy to transcribing books into Braille, thus making the writings of many authors available to persons without sight.

Current Articles of Interest

Primary Hereditary Nystagmus, Mary Allen, M.D., *Journal of Heredity*, December, 1942, published monthly by the American Genetic Association, Thirty-second Street and Elm Avenue, Baltimore, Maryland. A pedigree is given of a primary hereditary nystagmus which appeared to be dominant and not sex-linked. There was no defective macula, no history of albinism. The pattern of transmission was irregular dominant.

A summary states:

"1. Case histories are given of four children with a nystagmus fitting Waardenberg's classification of Primary Hereditary Nystagmus; dominant type.

"2. Vitamin D deficiency concomitant with this condition could easily cause confusion of the condition with spasmus nutans in the younger children if family history had not been investigated.

"3. The lesion is probably of central nervous system origin, and individuals in this group having the more stable nervous system had the less noticeable defects.

"4. The family tree is given because the condition seemed rare enough to warrant reporting as many individuals as possible in the group.

"5. According to ophthalmologists, errors of refraction in these cases should be treated as in cases without nystagmus."

Exophthalmos Associated with Thyroid Disease, Algernon B. Reese, M.D., *New York State Journal of Medicine*, October 1, 1942, published bimonthly by the Medical Society of the State of New York, 292 Madison Avenue, New York, N. Y. The operative procedure of choice for cosmetic purposes is indicated in the cases of: (1) hyperthyroidism in which the retraction of the upper lid, and not exophthalmos, is the principal cause of disfigurement; (2) disfigurement caused mainly by exophthalmos; and (3) disfigurement caused by both retraction of the upper lid and exophthalmos. Operative treatment is also indicated for cases in which exposure of the cornea is imminent, both when malignant exophthalmos is present and when that condition is not present.

Nystagmus Through Four Generations, Marion LeRoy Billings, *Journal of Heredity*, December, 1942, published monthly by the American Genetic Association, Thirty-second Street and Elm Avenue, Baltimore, Maryland. The author presents a report and diagram of nystagmus, sex-linked recessive type, which has appeared through four generations, with a definite transmission from affected males to half their daughters' sons.

Developmental Cataracts, Harold F. Falls, M.D., *Archives of Ophthalmology*, February, 1943, published monthly by the American Medical Association, 535 North Dearborn Street, Chicago, Illinois. Dr. Falls summarizes the results of surgical treatment in 131 cases of developmental cataract at the ophthalmic clinic of University Hospital in Ann Arbor, Michigan, between the years 1925 and 1942. In all cases the cataract had been noticed at birth or shortly thereafter. No patient was operated on if the visual acuity was shown to be better than 6/15. Proved inheritance or familial tendency was present in 16 per cent of cases, and continuing investigation in the genealogic trees in many cases indicates that a greater percentage may be expected.

Fifty-five per cent of patients were operated on under the age of 8 years, 17.5 per cent under the age of 2 years. Twenty-five per cent of all failures occurred in patients operated on during the first year of life. However, it must be taken into consideration that these children offered in any case a poorer prognosis, since they had complete cataracts, whereas the children who were allowed to reach school age had sufficient preoperative vision to enable them to get about.

With regard to final visual acuity, the best results were obtained when the patient was first operated on between the ages of 4 and 10 years.

Operative techniques are described.

The frequency—52.6 per cent—of associated ocular disturbance such as nystagmus, strabismus, microphthalmos and subluxation of the lens emphasizes the tendency toward defective germ plasm present in these patients. In addition, general constitutional disturbances, either congenital or metabolic, appeared in 29.7 per cent. The author recommends that the ophthalmologist be cautious

in prognosticating normal mental development after a successful operation, despite the numerous reports citing pronounced post-operative improvement in intellectual status, for he found actual cerebral developmental dyscrasia to be frequently present. Four patients in this series were institutionalized for mental deficiency.

Dr. Falls offers the following conclusions and recommendations:

"1. Persons with developmental cataracts are extremely likely to have associated ocular or constitutional congenital anomalies. These persons have poor protoplasm.

"2. It is suggested that in the case of complete bilateral cataracts, operation be performed on one eye after the patient reaches 6 months of age. The other eye may be surgically treated after the age of 2.

"3. If the cataracts are incomplete and the child can get around, surgical intervention should be postponed until the third or fourth year of life.

"4. In the present series, in very young children discission of the lens capsule proved to be the safest technique, and although complications were frequent they were fortunately minor.

"5. The best visual acuity was obtained when the combined technique of discission and linear extraction was employed.

"6. Of 233 eyes, 83, or 35.5 per cent, obtained a final visual acuity of 6/12 or better and have permitted the patients to maintain a useful place in society.

"7. Contraception is urged when the cataract is familial.

"8. Sterilization is recommended when the offspring displays a lenticular defect which is proved hereditary.

"9. Surgical intervention in early life is hazardous, as shown by the fact that a high percentage of complications and 33 per cent of the total failures (from light perception to no vision) occurred in the age group under 2 years."

Compensatory Divergent Strabismus, C. A. Clapp, M.D., *Southern Medical Journal*, January, 1943, published monthly by the Southern Medical Association, Birmingham, Alabama. The author states that skiascopic refraction should be attempted, whereas operative intervention designed to straighten the eyes is absolutely contraindicated, for if made parallel by operative procedures, they eventually assume the bilateral divergence. Divergent strabismus in very young children, where a bilateral chorioretinal atrophy or coloboma exists, is infrequently seen.

Discovering the Student with Impaired Vision in the Schools, James Houloose, M.D., *The Journal of Health and Physical Education*, December, 1942, published monthly by the American Association for Health, Physical Education and Recreation, 1201 Sixteenth Street, N.W., Washington, D. C. The new philosophy that education has to do with the whole child, and not with just his intellectual function, makes it the responsibility of parents, teachers, and administrators to see that the child's sensory avenues of experience are maintained at their highest efficiency. Many authorities say that a child with a mental age of less than six and a half should not be required to begin the phases of education which involve reading and writing. Physical immaturity, especially immaturity of vision, is an important factor in reading disability.

The author considers the theory that educational programs of today are "eye destroyers." The practice of basing admission and, in general, administration of the school program on chronological age, without paying attention to perceptual and other variable physiological abilities, is thought by some educational psychologists to be harmful. Inadequate lighting, the prevalence of glare and bad typography, and the use of old-fashioned flat-topped desks for reading are some of the stumbling blocks to good vision to be found within the classroom itself. The large number of eye defects that remain uncorrected after being found is due to many factors, including lack of correct recording on school health records, lack of follow-up, lack of facilities, and low economic level. The greatest factor, in the experience of the author, is lack of parental interest. ". . . On the basis of a combination of Snellen and Keystone Telebinocular tests of 365 specially referred children, 136 parents were sent recommendations for refraction. In the following up the next semester, we found that 8 parents had completed the recommendation, 79 promised to follow the recommendation soon, and 49 assumed and acted on the principle that the recommendation need not be followed." In other words, not only must reports be followed up, but parents must be convinced that there is a need. The detection of defects and conservation of vision are thus seen as dual obligations.

An eye health program evolves from the school health department's choice of (1) how and (2) when it will find the student with

impaired vision, (3) what it will do about the findings, and (4) whether it will initiate a sight conservation and a preventive program.

Slit-Lamp Microscope in Nutrition Surveys, J. H. Kodicek, M.D., and John Yudkin, *The Lancet*, Vol. 243, No. 6626, December 26, 1942, published weekly by The Lancet, Ltd., 7 Adam Street, London. Another contribution to the literature on the subject of the relationship between vitamin A and epithelial changes and that between riboflavin and corneal vascularization is summarized by the authors as follows:

"An examination with the slit-lamp microscope has been made of the eyes of 496 elementary-school children in Cambridge, aged between 8 and 11 years.

"Corneal vascularization, taken as an actual invasion of the clear cornea with vessels from the limbus, and said to be indicative of deficiency of riboflavin, has been found in about 4 per cent of the children. The proportion was significantly higher in older than in younger children.

"The importance of examining the epithelial layer of the conjunctiva is stressed. Reasons are given for supposing that this is more likely to show changes due to dietary deficiency, especially deficiency of vitamin A, than examination of the subepithelial tissues according to the method of Kruse and his co-workers. Opacities in these subepithelial tissues have not been observed in the children examined by us.

"Our observations have led us to classify the various findings in the epithelium into 5 groups. The first contains those children whose conjunctival epithelium is perfectly smooth and transparent, while the other groups contain those showing varying degrees of wrinkling and opacity. It is suggested tentatively that these represent 5 grades of increasing severity of change.

"The factors which appear to affect the production of these epithelial changes are age, economic status and sex. Thus, children with smooth transparent conjunctival epithelium (group 1) are less common at the higher ages, in the poorer school, and amongst boys rather than girls. It must be emphasized, however, that we do not know the cause of these epithelial changes; in particular, we do not claim at this stage that they are due to deficiency of vitamin A."

Book Reviews

READING AS A VISUAL TASK. Matthew Luckiesh, and F. K. Moss. New York: D. Van Nostrand Company, Inc., 1942. 428 p.

Reading is recognized to be a difficult, energy-consuming task, consequently any efforts to ease the process for the scholar or worker are eminently worth while. The authors, recognized experts in illumination research, in undertaking the scientific research studies reported in this book have sought facts that could be applied to improve conditions that affect ease of reading, to ascertain under what conditions various deleterious effects can be minimized. They admit that reading is far more than a visual task, but observe that conditions that affect seeing while reading are highly important.

Intuitive judgments in matters of illumination and factors that affect ease of reading are not to be trusted. Objectively determined criteria established with laboratory controls eventuating in standards expressed in terms of measurement are essential to eliminate guesswork in determining the factors that affect the reading task. With these objectives in view, the authors have conducted a notable series of research studies over a period of years that afford a sound basis for establishing standards having practical applications.

Instead of *legibility* the authors prefer *visibility* and *readability* as describing more accurately the criteria for evaluating physical factors that affect reading—duration of the task, glare, type size and face, line length, paper and inks. Factors involved in visibility are evaluated with the authors' Visibility Meter; the criterion chosen for determining readibility is the involuntary eye-blink. Speed of reading is considered as an undesirable criterion for this purpose because it is subject to voluntary control by the reader. The eye-blink is obviously an extremely limited criterion for the purpose, the reliability of which varies with the conditions under which it is tested. This fact the authors themselves admit when they describe the precise laboratory conditions under which it has been necessary for them to operate to obtain reliable results. Some of their conclusions appear to be based on rather tenuous evidence derived from comparatively small numbers of cases.

The authors have intentionally avoided becoming involved in

the psychological factors that are a part of reading. They have controlled certain of these factors in part by using uniform content and experienced adult subjects with superior educational background. Under these conditions it is obvious that the whole story has not been told. We know little about how comprehension difficulties affect reading efficiency in these experiments. Whether standards based upon work with highly literate adults can be applied directly to juvenile readers is another question.

At many points the practical applications of the research findings to easing the reading task are indicated. Chapter 13 gives a summary of the optimum specifications for readability in terms of type-size, spacing, line length, illumination, type-face. A practical illustration of how the findings may be applied to a problem involving the preparation of printed material is included. The application of the findings to establishing standards for sight-saving classes is given considerable attention. The need for better illumination for the visually handicapped reader is stressed above all other factors. In this connection there is a brief description of the most common visual deficiencies.

A glossary of the technical terms used is appended and reproductions of text printed in various type sizes and type faces are included. The bibliography contains references to the many separate research studies on which the contents are based.

The authors have practiced what they preach in applying their findings in constructing this volume which is a model in arrangement and typography. Excellent charts, ingenious diagrams and a number of photographs showing the laboratory equipment used in the experiments add much to the reader's understanding of the context.

The contents will be of most interest to the specialist who must make decisions regarding lighting conditions, who must prepare graphic materials for publication; or for those who require information concerning visual standards for sight-saving classes. There is some repetition in the book that might have been eliminated, and some orientation material is placed in the back instead of the forepart of the book where it would have been most helpful. This book calls for serious study of every section for the fullest comprehension of its contents.

—Gertrude Hildreth, Ph.D.

OFTALMOSCOPIA CLINICA (Clinical Ophthalmoscopy). Tomas R. Yanes. Habana: Biblioteca Medica de Autores Cubanos. 1943, 500 p. illustrated.

This book is the outgrowth of a course given to general physicians at the Eighth National Medical Congress of Cuba. It is primarily intended for medical practitioners and students, but the author has covered the whole subject of ophthalmoscopy adding several chapters at the end of the book. The edition of original books in Latin America, with probably the exception of Argentina, is a difficult and costly enterprise and rarely a financial success. It is probable that Dr. Yanes had difficulty in printing and especially in illustrating his book. He had to use reproductions of Oeller's *Atlas of Fundus Diseases* for all the color pictures. Unfortunately the black and white illustrations are mainly photographs which do not show well. Some of them are blurred and lacking in detail, failing to give the reader an accurate idea of the conditions represented. Perhaps in later editions Dr. Yanes may be able to correct these defective pictures, thus enhancing the value of his book.

The description of the fundus in the normal eye is well made in a brief and comprehensive way. The descriptions of fundus diseases are short and made especially from the clinical standpoint. Rarely is there any pathological basis sought for the explanation of symptoms or fundus disturbances. The author has added at the end an interesting chapter on "The Prognosis from the Standpoint of Fundus Lesions" in which he reviews diseases such as syphilis, tuberculosis, renal conditions, diabetes, and cerebral tumors.

The book is timely and will bring the subject of medical ophthalmoscopy to the attention of general physicians, encouraging a more widespread use of the ophthalmoscope.

—MANUEL URIBE TRONCOSO, M.D.

WHY WE HAVE AUTOMOBILE ACCIDENTS. Harry De Silva. New York: John Wiley & Sons, 1942. 394 p.

No one can read Dr. De Silva's book without the feeling that traffic safety is gradually becoming a science. For the author has constructed the pattern of his chapters by carefully weaving into the text the results of over a hundred research studies and reports of findings. Dr. De Silva's wide experience, first with the Bureau for Street Traffic Research at Harvard, and later with the Esso

Foundation at Yale under the direction of the American Association of Motor Vehicle Administrators, has given him an unusual background of technical research and practical application.

Since traffic safety is relatively new, it is refreshing to see the number of able studies that have been conducted in order to prove some of the procedures in reducing accidents. The first chapters of the book deal with the highly important subjects of driver testing, license examinations, and the basic causes of accidents. It is in this field especially that the author has made his greatest contribution. He shows that good vision is one of the most important requirements of the safe driver, and presents evidence to prove that lack of visual acuity, poor peripheral vision, inability to withstand glare, and other visual weaknesses may be important basic causes of traffic accidents.

Those who are familiar with Dr. De Silva's work know that he had much to do with the improvement in the State License Examination and the preparation of model drivers' manuals that have been adopted and widely distributed throughout the country. However, one is impressed with the fact that actual practices, such as examination of drivers, the enforcement of regulations, and educational procedures to train drivers lag far behind our knowledge and information as to the best methods. There are still far too many states with inadequate license laws, ineffectual education and enforcement programs, and poorly developed traffic court procedures.

An important part of the text is concerned with a program of education, enforcement, and engineering, under the leadership of state and national agencies, with co-operation from private agencies such as safety councils, automobile clubs, and insurance organizations. The author offers some excellent suggestions for carrying on co-ordinated programs.

What effect is the war to have on our traffic problems? We are already witnessing many changes because of priorities, rationing, and the rubber shortage. The use of the motor car for travel is steadily decreasing, and accidents show a downward trend. But the automobile problem will always be with us. We can but hope that this period will be a time for traffic authorities to take stock and plan more adequate procedures, so as to be ready for a more sensible and vigorous attack on the traffic safety problem.

—HERBERT J. STACK, PH.D.

VISION, A STUDY OF ITS BASIS. S. Howard Bartley. New York: D. Van Nostrand Co., 1941.

Dr. Bartley has written a highly technical book which includes much of the psychologic and physiologic data that have accumulated concerning the visual process. Important material has been omitted, however, including among other things the entire field of color vision. The book is far from being a complete compendium of visual physiology, as its title might imply.

The first step in the visual process is a photochemical one, occurring in the cone and rod cells of the retina. These cells emit neural impulses as a consequence of photochemical activity, in the same manner that the end organs of every sense give rise to neural impulses when they are acted upon by external stimuli. It is only the fact that the sensory cells of the eye are sensitive to light which makes the eye an organ of vision. The specific properties of vision can therefore be best studied by the behavior of the cone and rod cells.

The neural impulses from these cells are relayed through various synapses in the retina and the brain until visual perception is achieved. Dr. Bartley's background is that of a psychologist and neurophysiologist; for this reason he places great emphasis on the neural factors involved, minimizing the primary photochemical nature of vision. It is the interaction among the neural relays of the retina, the bipolar and ganglion cells, which, Dr. Bartley contends, is the determining factor in most visual experiences. However, the evidence he cites to support this thesis is often highly dubious.

Because of the technical nature of the book it will interest only those who are somewhat familiar with visual physiology. Since the contents do not by any means stress the most important aspects of retinal physiology but instead are selected to illustrate the author's thesis, it will be necessary for the reader to apply a critical faculty in evaluating it.

—JOSEPH MANDELBAUM, M.D.

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Medical First Aid in Eye Accidents and Injuries*

J. M. Carlisle, M.D.

THIS article is of timely importance, especially to industry—industrial physicians, nurses, and safety engineers.

First Aid Treatment at the Scene of the Accident

When an irritant chemical has entered the eye, the first objective should be the immediate removal of the offending agent. This can best be accomplished by immediate irrigation of the eye with copious quantities of clean running water. The patient should then be sent directly to the medical department.

Foreign bodies entering the eye, if not having chemically irritant properties or not producing a burning sensation, should not be touched at the scene, but the patient should be sent directly to the medical department. If there is an irritant reaction or a burning sensation from the material, the patient's eyes should be flushed with water immediately at the site of the accident.

Traumatic injuries should not be touched at the site of the injury but the patient should be sent directly to the medical department.

Treatment of Chemical Injuries in the Plant Medical Department

(1) Test reactions of the contents of the conjunctival sac by lightly touching indicator paper to the mucous membrane surfaces of the lower fornix. (Litmus paper is poor because a large pH shift is required before a color change from the blue to red or from red to blue occurs. Alkacid test paper or pHydrion paper is much better because definite and easily recognizable color changes take

* Extracted, with permission, from "Medical First Aid," appearing in *Industrial Medicine*, Vol. XII, No. 2, February, 1943.

place with a pH shift as small as 0.2 of a pH unit. Nitrazine paper is satisfactory for acid burns, but poor for strong alkali burns.)

(2) Local anesthetic should be placed in the eye.

(3) Thoroughly wash the eyebrows and tegument surrounding the eye in order to remove all residual chemical or foreign particulate matter which may be present. This may be done while the anesthetic is taking effect.

(4) Copious irrigation of the eye with saline or distilled water should be immediately instituted.

(5) Place two drops of a 2 per cent sodium fluorescein solution on the eye, allow a minute for staining of any denuded area, and then rinse with physiological saline.

(6) Examine the eye under a strong beam of light with the aid of a magnifying lens. This should be followed by slit-lamp examination.

(7) If there is still discomfort after the above procedure, local anesthetic may again be placed in the eye, then followed by irrigation.

Definitive Treatment for Acid Burns.—(1) Sodium bicarbonate (2 per cent solution) or a buffer solution for acid burns should be instilled over the globe and into the conjunctival sac from an eye-dropper in quantities of 3 to 5 c.c. every three to five minutes for 15 minutes. (The glass tube of an eye-dropper holds about 1 c.c.) While the duration of this irrigation will depend upon the cause, type, extent and severity of the injury, the irrigation should always be continued until there is a maintained neutral reaction upon testing the secretions in the fornices.

Note.—Most acid burns of the eye are instantaneous and not progressive and consist essentially in the precipitation and perhaps denaturing of the tissue proteins. The severity of the burn seems to depend upon the pH of the acid, the degree of dissociation, the character of the anion, and, most important, the time that the acid remains in the eye before it is diluted and removed. As a general rule, acid burns heal more rapidly and are much less difficult to handle than are alkali burns.

(2) Local anesthetics generally used are pantocaine, butyn, holocaine. Most uncomplicated cases of acid burns require a local anesthetic, an oily lubricant, and some bacteriostatic substance in

the cul-de-sac during the first 24 hours. The combined facilities and advantages of anesthetics, antiseptics, and lubricants are offered in butyn and metaphen or metycaine and merthiolate ophthalmic ointments. In every burn of the eye a symblepharon may develop if two denuded mucous membrane surfaces are approximated and immobilized. Liberal quantities of these or other ointments, together with twice daily compulsory inspections, will prevent many a symblepharon.

(3) Dark glasses, atropine, eye pads—the advantages to be derived from any or all of these when needed should not be overlooked.

As a general rule, acid burns are not progressive and secondary treatment is largely symptomatic. Additional measures include the use of the following:

a. Boric acid and ophthalmic ointment, together with an eye pad, or the instillation of sterile castor oil, cod liver oil or olive oil. (These will alleviate the symptoms which usually accompany acid burns, as well as promote regeneration of the corneal epithelium.)

b. Removal of any discharge from the fornices by instillation of a mild silver protein 10 per cent solution followed by copious irrigations of boric acid.

c. Butyn and metaphen ointment. (Rapid but short-acting local anesthetic.)

d. Metycaine and merthiolate (slower than butyn but more prolonged action).

e. Holocaine (phenacaine) 1 per cent should be used. (Cocaine should not be used in view of the fact that it delays healing, softens and swells the cells, and produces further damage to the epithelium.)

Definitive Treatment for Alkali Burns.—(1) Buffer solution for alkali burns should be instilled over the globe and into the fornices from an eye-dropper in quantities of 3 to 5 c.c. every three to five minutes for *30 to 50 minutes*. (The glass tube of an eye-dropper holds about 1 c.c.) While the duration of this irrigation will depend upon the cause, type, extent, and severity of the injury, the irrigation should always be continued until there is a maintained neutral reaction upon testing the secretions in the fornices.

Note.—Since alkali burns, unlike acid burns, are nearly always progressive, there is a great deal that the first aid as well as defini-

tive treatment has to offer, and especially does this apply to the benefits that will accrue from the continued irrigations with a mild buffer solution. In many cases it is advisable to keep these irrigations up for one-half hour or more.

(2) Cold compresses are useful in inflammatory affections of the conjunctiva. Edema of the lids and chemosis, so frequently seen in these burns, may be measurably reduced by a small cotton ball saturated with buffer solution, covered with a 4 x 4 inch gauze compress moistened in the cold buffer solution placed over the lids, or by the dry method (ice-bag), which, as a rule, is less painful to the patient if the skin of the face and forehead is protected. Ice should never be applied to the lids directly.

Note.—Since strong alkali solutions penetrate deeply into the cornea within a very few seconds, a resultant corneal ulcer may be anticipated by the swollen corneal stroma with leukocytic infiltration. Frequently the cornea temporarily becomes less cloudy, but on the fourth to eighth day a pannus of blood vessels enters the cornea from the limbus, over which the corneal epithelium does not regenerate. In the event the cornea or conjunctiva is severely burned and appears white or gray, a symblepharon or corneal lesions, including adhesions between the lid and the eyeball, may develop.

(3) Dark glasses, atropine, eye pads should be used as required.

Additional routine measures in the treatment of alkali burns of the eye should include:

a. Instillation of atropine sulfate—1 per cent ophthalmic ointment or solution (the solution when irrigation, the ointment when oil is used).

b. Careful twice-daily inspection for adhesions between the lids and the globe. (A glass rod—cocktail stirrer—is very useful in breaking these adhesions.)

c. Liberal quantities of boric acid ointment placed between the globe and lid to act as a barrier and serve in further prevention of adhesions.

d. Any discharge removed from the cul-de-sac by the instillation of a mild silver protein 10 per cent solution, followed by copious irrigations of boric acid.

e. Sulfathiazole ophthalmic ointment, 5 per cent, is a very useful

agent in preventing secondary infections. (Contra-indication is the frequently occurring irritation following the use of this drug in the eye.)

f. Butyn metaphen or metycaine merthiolate ophthalmic ointments may be used when rapidly acting local anesthetic and bacteriostatic effects are desired.

g. Holocaine (phenacaine), 1 per cent, should be used when a higher degree of anesthesia is necessary. (Cocaine should not be used in view of the fact that it delays healing, softens and swells the cells, and produces further damage to the epithelium.)

Definitive Treatment for Alkaloid Burns.—(1) Sodium thiosulfate (3 per cent solution) or some other specific mild oxidizing or reducing agent should be instilled over the globe and into the cul-de-sac from the eye-dropper, in quantities of 3 to 5 c.c. every three to five minutes for 30 to 50 minutes. While the duration of this definitive treatment will vary, depending upon the nature of the irritant and the time of exposure, subsequent treatment is essentially the same as for alkali burns.

Note.—Alkaloidal reactions are often insidious in their onset, since some produce immediate reactions and others produce signs and symptoms only after a quiescent period varying from four to 24 hours.

Treatment for Lime Burns.—While a freshly prepared 4 per cent solution of ammonium tartrate (reagent grade) is isotonic with lacrimal fluids, it rapidly turns acid upon standing. It is, therefore, advisable to test the solution before and during use. A solution that is over one hour old should not be used.

Treatment for Lacrimator Burns.—Since the gases, vapors, and liquids of lacrimators likely to be encountered as a result of enemy action may produce very severe injuries to the eye, definitive treatment other than the use of a 2 per cent solution of sodium bicarbonate should be obtained from sources affording specific therapeutic measures for these specific chemical war injuries.

Treatment for Flash Burns.—Boric acid solution used as an eyewash, castor oil as a lubricant, and holocaine for the relief of pain usually allow for complete recovery within four or five days. Mild anesthetics do not, as a rule, afford relief from the very severe pain which almost invariably follows even momentary flash exposure.

First Aid Treatment for Superficial Foreign Bodies in the Eye

The following are the only three first aid measures that the nurse or first aid attendant should be allowed to undertake in the removal of foreign bodies in the conjunctival fornices or on the eye:

(1) Rubbing the unaffected eye in an effort to produce lacrimation, which in turn may flush the foreign body from the eye or fornices.

(2) Irrigating the eye with clean water, physiological saline, boric acid solution or some satisfactory collyrium.

(3) Lightly passing or rolling a moistened cotton pledget over the corneal or conjunctival areas containing the foreign body. If this manipulation does not remove the foreign body, then the services of a physician should be obtained.

It is of great importance that first-aid routines should not include any more vigorous actions than the above. Unless measures are taken by the physician, undue and unwarranted destruction of tissue as well as contamination and resultant infection frequently results from the ministrations of well-meaning individuals with unskilled and untrained hands.

One frequently overlooked step in the treatment of foreign bodies in the eye is the prevention of a recurrence by removing from the eyelashes and eyebrows all particles which may have accumulated there. In many instances these are the same type of particles that were removed from the eye. Therefore, the cleansing of the eyelashes, eyebrows, and skin of the orbit is of considerable importance.

When a local anesthetic is used to aid in the removal of a foreign body on the eye, it is extremely inadvisable to allow the patient to leave the dispensary without first placing a pad over the eye, if the patient leaves before the effects of the anesthetic have worn off. Frequently marked damage results from allowing the patient with an anesthetized eye to return to the environment in which he acquired the first foreign body. He could detect the foreign body previously, but now he is unable to feel it because of the anesthetic.

Definitive Treatment for Superficial Foreign Bodies in the Eye

It is of the utmost importance that the patient be placed in a satisfactory position which will allow for perfect comfort and re-

laxation on the part of the patient as well as on the part of the physician.

These objectives can best be accomplished by the following:

(1) Place patient in reclining position.

(2) Administer local anesthetic, butyn, or pantocaine.

(3) The physician should sit at the patient's head. His elbows should rest on the cot, with his hands and face in such a position that he is looking and working from above downwards over the globe of the patient's eye.

Note.—There is much less danger of causing damage to the eye in this position than in having the patient sitting in a chair and the operator working from a sitting position in front of the patient. Working from in front, a slip of the physician's instrument is almost certain to result in puncturing or otherwise severely damaging the patient's eye—working from above, a slip is likely to give only a tangential injury of much lesser severity.

(4) No patient should be allowed to leave the dispensary after a foreign body has been removed from the cornea or conjunctiva without first placing onto the bulb a couple of drops of 2 per cent sodium fluorescein solution or aqueous mercurochrome. Frequently in cases where there is a history of a foreign body but no foreign body is found, fluorescein instillations will reveal scratched surfaces of the cornea which are missed without the staining aid.

The use of some lubricant with or without some local anesthetic and/or antiseptic, together with an eye dressing, should be continued until healing is complete. This can be determined by the failure of the cornea to stain with a 2 per cent sodium fluorescein solution or aqueous mercurochrome.

Treatment of Penetrating Foreign Bodies

These are by and large the most troublesome of eye injuries so far as permanent disability is concerned. The very best form of treatment for the industrial physician to use in the majority of instances is as follows:

(1) Apply eye pad and head bandage.

(2) Send the patient immediately to a hospital for care by an eye specialist and for removal under the exacting ritual of the operating room if additional measures are needed.

Note.—While a firm bandage over one eye will frequently eliminate friction between the eyeball and eyelid, if immobilization of one eye is required, both eyes must be bandaged.

Treatment of Corneal Abrasions

Corneal abrasions and deep lacerations not only expose the delicate nerve fibers, but also constitute a portal of entry for contamination. As a result, serious inflammation and infection frequently ensue. Corneal ulceration, often leaving permanent scarring and diminution of vision, may ultimately result. Immediate and proper definitive treatment is imperative if these serious sequelae to corneal injury are to be prevented or minimized.

Only a competent specialist in injuries of the eye is qualified to carry out adequate treatment for any but the most superficial lesions, and for this reason the physician in industry should confine his efforts to immediate diagnosis and simple measures for the relief of the intense pain caused by most corneal injuries. After a sterile dry gauze dressing has been applied over the eye and held in place by a circular bandage, the patient should be sent immediately to the eye specialist.

The instillation of a local anesthetic is usually the most effective means of securing immediate relief from pain. An aqueous solution should be used if the patient has not yet been seen by the ophthalmologist, since oily substances in the eye interfere with proper examination.

Conclusion

Of all the commonly occurring injuries seen in industrial practice, those to the eye carry the most serious potentialities for permanent, serious disability. Proper early treatment, however, can usually greatly minimize or prevent such a result. It must be re-emphasized, therefore, that all but the most trivial of eye injuries should be promptly referred to an ophthalmologist if the welfare of the employee, the pocketbook of the employer, and the reputation of the industrial physician are to receive maximum protection.

What Everyone Should Know About Glaucoma*

John M. McLean, M.D.

THE author points out what everyone should know about this blinding disease.

I WANT to talk to you about the eye condition known as glaucoma. Right here and now some of you may wonder what in heaven's name is glaucoma and also what earthly reason is there for being interested in glaucoma. I can answer that for you. If you prize your eyes, if you want to retain your sight, it is important that you should know about the menace of glaucoma. You should be interested in it because, if you know of its menace and are acquainted with its first signs, you may possibly save yourself from permanent disability should it strike you, or one of those near to you.

Thousands of people in this country are blind in both eyes. One out of every four of them is blind from glaucoma. Most of these unfortunate individuals are blind because glaucoma was not discovered in the early stages. Early diagnosis is of great importance.

The underlying cause of glaucoma is not known. Until the war many of the best eye physicians were hard at work tracking down the cause. Now most of their energies and talents are directed into other channels, but as soon as this war ends, the study and research in glaucoma will be resumed with added vigor. In the meantime this disease can be treated and can be controlled. Blindness can be prevented.

Over 90 per cent of the people who get glaucoma can have their sight saved if the disease is discovered soon enough. Most of those who go blind from glaucoma fall into two groups. The first are those who do not realize until very late that they have the disease.

* Presented originally as a radio talk.

The others are those who know they have it but disregard the doctor's advice and fail to carry out the proper treatment.

Why is it so important to discover glaucoma in its early stages? Because the damage which it causes can never be undone. That portion of the eyesight which has been destroyed can never be regained. But the damage can be stopped. Glaucoma can be controlled.

The public should know more about glaucoma. It is a disease which usually strikes people over forty and practically always attacks both eyes. It causes the pressure within the eye to become increased. That increased pressure is more than the delicate nerve fibers within the eye can stand. They are crushed until they atrophy and one by one they die. Since we cannot bring these dead tissues back to life, we cannot restore that part of the eyesight which has already been lost. Since we do not yet know the fundamental cause of glaucoma, we cannot prevent it; but we can control the pressure and preserve what eyesight is left. This is not a cure but it is control. It is not prevention of the disease, but it is prevention of blindness from the disease.

Glaucoma existed long before the fifth columnist or the saboteur was invented. The method of attack is the same—quietly destroying, silently boring from within, without warning, without notice.

How can you tell if you have glaucoma? Unfortunately, most of you can't. If the pressure within the eye becomes very high, that causes pain which gives you warning. Usually the pressure is high enough to do damage but not high enough to give you pain and warn you that your eyesight is threatened.

If glaucoma causes you pain, you are lucky. The pain will bring it to your attention. You will know enough to get expert care. But most of you who may have glaucoma will not have pain. Most of you will have no warning, or such slight indications that you will ignore them. Do you have to change your glasses frequently? Do you have slight dimming of vision? Do your eyes become a little red now and then? Do you have difficulty finding a seat in the movies? Do your eyes or head ache after a prolonged stay in the dark? Do you see halos around street lights? These things do not necessarily mean glaucoma, but they may. You may not even have these warnings.

When you reach the forties or thereabouts, most of you will have to have reading glasses. At least 20 per cent of you will get your glasses from eye physicians. You will be safe. If you have glaucoma, it will be discovered and you will be properly advised about treatment. The rest of you get your glasses from other sources. However, most of you go to your family physician. Ask him about glaucoma. Tell him about your eye symptoms. If you are over forty, ask him to feel your eyes through the closed lids to see if they are too hard. Ask him to look into your eyes with his ophthalmoscope for signs of pressure injury to the optic nerves. If he finds glaucoma, or if he suspects glaucoma, ask him to refer you to a competent eye physician. If your family doctor does not know one, ask your county medical society for a list of good eye doctors. Don't be guided by your neighbors' ideas. Beware of large signs advertising "free eye examinations." They are too likely to be worth just what you pay for them. If you cannot afford a good eye physician's office fee, by all means go to a good eye clinic. There are plenty of them in the metropolitan area. They are well equipped and staffed with competent doctors who can discover and treat glaucoma if you have it.

What will your eye physician do in his examination? He will test your vision and refract your eyes. If you need glasses for reading or general use, he will prescribe them. He will examine your eyes from front to back. He will look into them and examine the delicate tissues inside. He will test your visual fields. That means that he will examine your side vision as well as your vision straight ahead. This is important, for glaucoma usually destroys the side vision before it attacks direct central vision. He will test you for blind areas at the spots particularly vulnerable to glaucoma. Then he will measure the pressure in your eyes with an accurate little instrument specially designed for this purpose. If there is even a suspicion of glaucoma, he will probably make a number of special tests.

If you have glaucoma, your eye physician will give you advice about your diet and habits. He will plan and give you specific treatment to arrest the disease. This planning may take several visits and a period of observation, for it must be fitted exactly to your eyes and your particular situation. Then he will advise you

how often you should be seen to have your progress checked. It is of utmost importance for you to co-operate with him in periodic re-examinations. Remember that glaucoma cannot yet be cured. It can only be kept under control, and this requires regular observation to prevent it from getting out of control.

Sometimes it is not possible to control glaucoma with medical treatment alone. It may be necessary to have an operation to form a sort of "safety valve" to keep the pressure under control. If such an operation is necessary, by all means have it performed while your vision is still good. Do not make the mistake of waiting until you cannot see. When there is little left to save, glaucoma has outwitted medical science. Give medical science a chance to outwit glaucoma for you. Take the necessary steps to save your eyesight while it is still there to save.

What I have described thus far is the common form of glaucoma: the "silent thief" of vision. There is another type of glaucoma which is worth mentioning. It occurs less frequently and is much less insidious in its onset. This is an acute form which strikes hard and suddenly with little or no warning. It may be brought about by a severe emotional upset. However, it soon makes its presence very obvious. Pain in the eye and pain in the head are severe and may be unbearable. The vision suddenly becomes very blurred and foggy. The eye is obviously inflamed. This form of acute glaucoma is just as much an emergency as acute appendicitis. Call your doctor or go to a hospital without wasting time. Active treatment must be started at once. More often than not an emergency operation will have to be performed. After a successful operation has cured the acute attack, chronic glaucoma may set in. It must be watched for and treated.

Finally, a word of general advice. If you are middle-aged or older, remember that there is such a condition as glaucoma. If members of your family have it, your chances of getting it are a little greater than otherwise. Find out if you have the disease. If you do not, don't become a neurotic worrying about it. If you do have glaucoma, stick to your doctor's advice and treatment. If an operation is necessary, do not put it off. Remember that they are the only eyes you have and that glaucoma can be controlled. Blindness from glaucoma should be prevented.

Epidemic Keratoconjunctivitis*

THE Council on Industrial Health has approved publication of this special warning bulletin on epidemic keratoconjunctivitis. —C. M. Peterson, M.D., Secretary.

THIS report is issued jointly by the U. S. Public Health Service and the Committee on Industrial Ophthalmology of the Section on Ophthalmology, American Medical Association. It is recognized that relatively few cases of epidemic keratoconjunctivitis will be reported in areas which are not essentially industrial, but the condition has appeared so extensively throughout the country that the agencies sponsoring this report hope that physicians everywhere will be prepared to apply the recommendations listed below promptly and effectively.

Incubation Period

The incubation period in epidemic keratoconjunctivitis ranges from five to ten days.

Clinical Manifestations

The onset may be preceded by a low fever and a mild generalized malaise. The local ocular symptoms are merely those of a foreign body or conjunctival irritation. One eye is usually affected first, and in a large percentage of these cases the second eye becomes infected within five to eight days. Preauricular and submaxillary glandular involvement with tenderness is common in a high percentage of cases.

Edema of the lids and the conjunctiva, especially the transitional fold, is very frequent. The conjunctiva presents the appearance of a simple purulent conjunctivitis but with little or no formation of

* Reprinted, with permission, from the *Journal of the American Medical Association*, Vol. 121, No. 14, April 3, 1943.

pus. Small areas of pseudomembrane are not infrequent and, when removed, leave either small white dotted points or some bleeding points. The bulbar conjunctiva becomes edematous early. At this stage there is some lacrimation and photophobia, but real pain and blepharospasm do not appear until the cornea becomes involved.

The proportion of cases in which corneal involvement occurs varies from 50 per cent to 90 per cent. In six to twelve days after the conjunctivitis appears, the cornea becomes involved by the appearance of discrete gray infiltrates that lie in and immediately under the epithelial layer of the cornea. They may be confined to the periphery of the cornea, but in a large percentage of cases involve the pupillary area of the cornea directly. These infiltrates are discrete and seldom become complicated by an erosion of the corneal epithelium, with resultant staining with fluorescein. The extent of visual impairment depends on the number of infiltrates and their location.

Clinical Course

The disease is self-limited. In the majority of instances the conjunctivitis disappears spontaneously in fourteen to eighteen days. The corneal complications may disappear in seven days or may last for many months. The longer they persist the greater is the danger of permanent visual impairment.

Laboratory Findings

The scrapings of the conjunctiva show a preponderance of monocytes. Cultures and smears either are negative or show the usual contaminations.

Treatment

There is no specific treatment that has shown a definite influence on the course of the disease. During the acute stage the eyes should be kept clean with irrigations of boric acid, isotonic solution of sodium chloride, or 1:5,000 mercuric oxycyanide. If there is much photophobia, 1 per cent holocaine may be instilled at frequent intervals. Five per cent sulfathiazole ointment has been used, as has 5 per cent solution of sodium sulfathiazole sesquihydrate. For

persistent corneal infiltrates, the *x*-rays have seemingly yielded some results.

Period of Infectivity

It is not yet known how long the danger of transmission to others exists. At present, for practical purposes, a sufferer from epidemic keratoconjunctivitis may be allowed to return to work when the active conjunctivitis has disappeared.

Preventive Measures

At present the only preventive measure known is complete isolation of infected persons. As the disease has been transmitted through medical personnel, the most meticulous asepsis must be insisted on. Not only must physicians and nurses wash their hands thoroughly with soap and water after each patient, but also eye droppers, solutions and instruments must be sterilized to prevent infection of noncontaminated persons. The infected individual must be told of the danger of transmission of this disease to others, not only in the plant, but even in the home surroundings. It is suggested that in industrial plants where epidemic keratoconjunctivitis has made its appearance the following methods be adopted:

1. In smaller plants with a limited personnel, every individual with a red eye should be stopped at the entrance of the plant and sent direct to the plant physician to determine whether or not epidemic keratoconjunctivitis is present. In larger plants where such a procedure is not possible, supervisors and foremen should be instructed in detail to make rounds immediately when a fresh shift starts and send any individual with a red eye to the medical office.
2. If the cases are to be treated at the medical department of the plant, a separate room should be set aside for such cases, and in that room there must be exercised the most scrupulous asepsis even to washing the arms of the chairs in which the patient sits. Aside from the aseptic and separate care of the recognized cases of the disease, special cleanliness of the hands of the physician in the general clinic should be maintained with the use of an effective disinfectant between cases lest the infection be spread by means of undiagnosed cases, especially those suspected of having foreign bodies in the eye.

3. Every case of epidemic keratoconjunctivitis should be excluded from communal facilities of the plant until the inflammation has subsided to the point where the plant physician considers it no longer transmissible.

4. Explicit instructions should be given to every individual regarding the danger of transmission, emphasizing the decrease in the war effort as a result of the time lost from epidemic keratoconjunctivitis.

5. The local health authorities should be notified immediately of the existence of individual cases.

Public Health Nursing in a Trachoma Control Program*

Margaret S. Vaughan, R.N.

DESCRIBES the service of public health nurses in field service in the control of trachoma.

PUBLIC health nurses are accepting additional responsibility as public health programs are extended into comparatively new fields. While trachoma is definitely not a new disease, the efforts to include it in a public health preventive program in Arkansas are very recent. The earliest year in which this disease was reported to the State Board of Health appears to have been 1920, when 252 cases were recorded. Certain areas of the state, particularly the northern half, were recognized as centers where prevalence of this disease was frequently observed by physicians. It was in 1919 that Dr. L. Gardner, an ophthalmologist, located in Russellville, Pope County, requested the U. S. Public Health Service, then interested in establishing hospitals in the trachoma areas of the United States, to establish a hospital in Russellville for the treatment of this disease. Dr. Gardner's request was granted, and an old family residence, still standing in the town, was rented by the citizens to become the hospital. Patients from the surrounding states—Mississippi, Oklahoma, Tennessee—were received and treated here by the staff assigned by the Service to the hospital. Treatment was entirely local—medical applications and instillations, mechanical expression of granules, surgery and irrigations. This, of course, was before the day of the use of the sulfa drugs. The hospital was discontinued in 1926 and no public program existed in the state for the treatment of trachoma until 1939. Private

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ophthalmologists, of course, continued to treat the disease in their regular practice.

The present program for control of trachoma is an outgrowth of legislation under the Social Security Act of 1935. Under the terms of this Act aid-to-the-blind programs were set up within the state under the Department of Public Welfare. A survey made in 1939 of cases receiving assistance in this program showed that 15 per cent of the blindness among applicants for aid to the blind resulted from trachoma. This survey also revealed that the disease was most prevalent in the northern section of the state. These facts established a definite need for a program of prevention as well as cure. A conference was held with Dr. Carl E. Rice, Surgeon, U. S. Public Health Service, in the spring of 1939 to determine the best method of controlling the trachoma problem in the state. It was decided to conduct a trial clinic in the northern part of the state, the detail of the procedure to be determined by the state consultant ophthalmologist. Because of lack of funds and the size of the district to be covered by the clinic, close supervision of the patient was not possible. The social status of the prospective patient being low, good co-operation could not be expected. Therefore, it was decided that large doses of sulfanilamide used under the conditions with which we must cope might have some unfavorable reaction. It was decided, therefore, to use very small doses of sulfanilamide supplemented by local application of the drug. The following procedure was set up, and the patients with no apparent physical disability which would contraindicate oral administration of sulfanilamide were thus treated:

The dosage was 20 grains per day to an adult male, 15 grains to an adult female, and 10 grains to a child. In addition to this, an 0.8 per cent solution of sulfanilamide was given to the patient to be dropped into the eyes four to six times per day. The patients who, for various reasons, were not considered good risks to treat orally with sulfanilamide, were given only the local treatment. The patients were all instructed to cleanse the eyes with warm water morning and night. No other medication was used. Each patient was given printed instructions to discontinue the tablets if any symptoms, such as nausea, rash, and the like, resulted, but to continue the drops.*

* Cosgrove, K. C.: Local Use of Sulfanilamide in Trachoma. *American Journal of Ophthalmology*, 1940, Vol. XXIII, August, pp. 911, 913.

Because the responsibility for administering the aid-to-the-blind program was established in the Department of Public Welfare, the trachoma control program was also planned and administered by this department. The initial plan was for diagnostic and treatment clinics in five areas in the northern half of the state, including follow-up supervision of the patients. The personnel employed by the Department of Public Welfare for this program consisted of a consultant ophthalmologist and one full-time nurse who had previously been employed by the State Department of Health. Five local part-time ophthalmologists were also employed to conduct the clinics in definite areas of the state. An initial clinic was held in each area after intensive publicity, which was followed by bi-monthly clinics in each area. The personnel of the local health departments in areas where clinics were held assisted at the clinics under the direction of the Department of Public Welfare nurse. This plan was in effect for eleven months.

In July, 1940, the trachoma control program was transferred to the State Health Department and placed under the Division of Communicable Disease Control. No change in the broad plan for carrying on the clinics was made; however, additional personnel, consisting of a full-time field clinician and one public health nurse, were added, making a field staff of one clinician and two public health nurses who worked with the local and supervisory ophthalmologists. This plan for carrying out a field clinic service, now definitely a health department responsibility, brought into focus the need for intelligent participation on the part of the local health personnel. There were many difficult problems: problems of additional personnel—public health nurses, clerks, lay workers—of suitable space and set-up; problems of equipment, good nursing procedures, and health teaching for the patients. These were some of the most apparent needs from the very first.

How was the public health nurse prepared for her new rôle? Although the trachoma control program was limited to less than one-half of the state, it was considered desirable to prepare the entire public health nursing staff for this new service. As assets to the problem, we counted our experience in conducting other types of clinics and our knowledge of communicable disease and understanding of basic communicable disease techniques. The need was for

more specific information in regard to the disease itself—a new one to many of the staff—and for appropriate routines and procedures for taking care of large groups of patients. Accordingly, a plan was devised for staff education in this subject. Briefly, this plan provided for six one-day study groups in selected centers within the state which were attended by the public health nurses and the medical directors from the separate local health departments. The material presented at these study groups was a combination of medical and nursing information. The field clinician of the trachoma control service presented information which the nurses and physicians needed for understanding the disease and giving intelligent care to the patients—cause, type, communicability and treatment. Lantern slides showing the typical appearance of the lids in the separate stages of the disease were shown; a vocabulary of eye terms was given. The second half of the day was spent in discussion of the nurse's part in the service, with a demonstration of the clinic set-up and of vision testing. Mimeographed material was distributed featuring the organization of clinics, use of the records, drawings of clinic set-up, and outlining duties for clinic personnel. The two field nurses assigned to the program had definite responsibilities in their respective areas. They were expected not only to make the arrangements for the clinic and "to work it up," but also to supervise and instruct the local nurses in observing the recognized procedures at the clinic.

In spite of much planning the clinics were far from satisfactory from the public health nurse's point of view, at this time. The number of patients attending the clinics was far too large to accomplish much more than the physician's examination and issuance of drugs. This also meant that additional nurses from the adjacent counties were assigned to assist on the clinic days, creating a further difficulty, since the local nurse in whose county the clinic was held frequently failed to have a conference with the patient after he had been seen by the physician. There was little time for any health teaching on a family basis.

Many patients suffering from refractive errors, strabismus, conjunctivitis, eye injuries, glaucoma and cataract came to the clinics and went away untreated because they did not have trachoma. These patients needed a service which the public health nurse could

assist them in receiving; they were a challenge to the public health nurse who was interested in the well-being of the whole patient. We felt that our interest, aroused to assist in a special service—trachoma—had led us to consider how a general eye service could be rendered.

The urgency of the nursing problems in connection with the clinic service forced our attention toward making improvements. To bring about the needed changes in procedures and to develop a general eye health program, a careful attack was planned. Advisory service was obtained from the National Society for the Prevention of Blindness, through a visit of their nursing associate to the state. A manual of trachoma nursing in use up to this time seemed inadequate and was revised to meet the needs of the nurses. An important change was made by delegating the responsibility for the clinic to the local health department instead of the trachoma field nurse. The local health department was responsible for all arrangements: contacting the patients, organizing clinic routine, instructing the personnel and supervising the clinic. The trachoma field nurse attended the clinics, but, as an assistant to the local nurse, she took her place as one of the nurses assisting in the many special nursing duties on the day of the clinic. The follow-up of the patients became a responsibility of the local public health nurse as a part of her generalized family health service.

The second phase of the efforts to improve this service from the public health nurse's point of view was directed toward stimulating the staff through more education about eye health.

Dr. K. W. Cosgrove, the supervising ophthalmologist of the Trachoma Control Program, generously offered his service in presenting three one-day lectures to the entire public health personnel, in which he presented an excellent review of anatomy and physiology of the eye, with special emphasis on some of the more frequently seen eye conditions.

In April, the National Society for the Prevention of Blindness again sent its representative to the state to give a two-day institute on eye health to a selected group of key nurses. This group was made up of the consultant nursing staff of the State Department of Health, teachers in schools of nursing, hospital administrators, nurses from hospital wards, boards of education, and the Red Cross

Chapter. Dr. Cosgrove participated, presenting a review of anatomy and physiology of the eye. Following this institute, the district nursing consultant staff of the State Department of Health planned and conducted two one-day study groups, composed of five to ten public health nurses, throughout the entire state. This breakdown of the information which had been presented at the institute reached every public health nurse employed by the State Department of Health. The material presented on the first day of the study conference included a review of fundamental knowledge of the eye and of the common eye disturbances and the causes of blindness; also the functions of the public health nurse which contribute to the promotion of eye health. On the second day the subject matter was on case finding and the promotion of eye health in the specific services of the public health program. References were given for future study; individual topics for discussion were assigned. There were free discussion and exchange of experiences and ideas. Information was presented concerning the state resources for patients with different types of eye defects: the Arkansas School for the Blind, the Department of Public Welfare and its program for remedial care, and the Crippled Children's Division and its services to the child with strabismus. Likewise was stressed the interest of various service clubs in helping children with eye defects. It was felt that these study groups served two valuable needs: the public health nurses were given a new sensitiveness to the importance of all the health factors which related to better eyesight, and the ways in which she could promote them; likewise, their knowledge was broadened regarding the trachoma clinic as a means of discovering patients in need of special attention. The revised material relating to the nurse's functions in trachoma control gave her definite instructions which would improve the quality of her participation in this program.

The services rendered by the trachoma field nurse at this time need a special word. Although the routine of the clinic has been worked out to a smoother pattern, and the number of patients attending clinics has been considerably reduced, permitting more individual teaching of the patient, it is important to bear in mind that an occasional clinic scheduled in a county has a tendency to be relegated to the background until the date for the clinic ap-

proaches. Also, with a turn-over in public health nurses occurring frequently, inexperienced nurses need special help. This applies also to the nurse who has been on the job since the inauguration of this program.

As a result of these things, the trachoma field nurse has a definite task constantly to assist the local public health nurses in recognizing the trachoma service as a part of their regular generalized health program; to assist them in carrying out good clinic procedures and in standardizing nursing techniques; to impress them with their responsibility to follow up the cases under treatment and bring their contacts in for examination; to keep complete records. She also encourages the development of educational programs in eye health in schools and other community groups.

The trachoma control program has been broadened now to include surgery for patients who receive this service through the Department of Public Welfare, which conducts field surgical clinics for this purpose. This imposes upon both the public health nurse and the trachoma field nurse the need for knowledge of policies of the Department of Public Welfare in regard to eligibility of the patients. It is also a part of their responsibility to assist in surgical clinics.

To sum up:

1. The public health nurse's services in a trachoma control program are essentially the same as in any other public health program for control of communicable disease.

2. Her knowledge and skill, developed as a result of a specialized service, challenge her to accept her responsibilities for rendering a broader and more complete service in every phase of her program.

"Pink Eye"*

Alson E. Braley, M.D.

THE author describes in layman's language the various types of eye infections which are generally known as "pink eye."

NEARLY all of us can remember the time we had "pink eye." We remember the frightening experience of awaking one morning and not being able to open our eyes. We cried for mother, who came to help us open them and to calm our fears. Mother would say, "Heavens, John, you have the 'pink eye.' Now all the other children will get it." Many of us did not visit a physician but were treated by mother with warm boric acid solution and perhaps some eye drops dad had bought in the drug store. We were out of school for about a week and, when we went back, the teacher wanted to make sure we would not give it to anyone. All our little friends wished they could have it so they could stay out of school a few days. If we were taken to a physician, we were told we had "pink eye" and were given some drops that made our eyes sting, but our eyes felt better and we were back in school a few days sooner. We did not realize the complexity of the situation at that time and many cases of "pink eye" developed complications.

Pneumococcus Eye Infections

Yes, "pink eye," in the technical sense of the phrase, is a simple disease. It is caused by small germs or bacteria that get into the delicate linings of the eye, causing an inflammation in the eye that is similar to the inflammation which occurs in simple sore throat. The term applied to the inflammation of the eyelids is called "conjunctivitis." During the spring, many children and adults develop acute conjunctivitis. Most of this is caused by a micro-organism

* Presented originally as a radio talk.

known as "pneumococcus." This is the same germ that causes pneumonia when it invades the lungs. This organism gives rise to an acute conjunctivitis with lots of pussy discharge. The eyes burn and smart and frequently there is a good deal of swelling of the upper lid. This type of conjunctivitis is quite contagious and may spread from one member of the family to another. A different type of acute conjunctivitis is produced by the influenza germ, which is frequently found also in cases of influenza. This type of conjunctivitis is usually not so severe as the pneumococcal conjunctivitis.

Koch-Weeks Eye Infection

A germ similar in some respects to the influenza germ was discovered by two world-renowned men, Dr. Koch, whom you will all remember as the man who first isolated the tuberculosis germ, and Dr. Weeks, a famous ophthalmologist, who worked here in New York City. These men found a micro-organism which caused the disease that physicians refer to as "pink eye." This organism is called the Koch-Weeks germ. Acute conjunctivitis is very contagious, recurring most often in spring and autumn. There is usually marked swelling, redness of the lids, and copious discharge. A Koch-Weeks germ infection of the conjunctiva spreads rapidly through the family and the school. Strict isolation technique must be carried out in order to prevent its spread. This consists of use of separate towels and wash-cloths, and care on the part of the infected person in handling articles belonging to others.

Staphylococcus Conjunctivitis

A type of acute conjunctivitis is produced by the staphylococcus. This micro-organism is the one that causes boils in the skin. It also causes styes and inflammation of the lid margins. This conjunctivitis is frequently associated with inflammation of the lid margins. It is often associated with inflammation of the lid border and has a tendency to recur unless the lids are also treated. Staphylococcic conjunctivitis is common the year around, probably because of a habit many of us have of rubbing our eyes with our dirty fingers. This carries the germs into the eyes and, when the germs are able to grow, an acute conjunctivitis is produced.

Streptococcus Eye Infection

The conjunctivitis produced by the streptococcus is usually quite severe. It may be associated with a sore throat or scarlet fever. The conjunctivitis is associated with marked pussy discharge and the development of a thick membrane on the surface of the conjunctiva. It may last a long time and requires vigorous treatment in order to prevent serious complications.

Epidemic Keratoconjunctivitis

At the present time a severe type of conjunctivitis has received a good deal of newspaper publicity. This conjunctivitis is called "California conjunctivitis," "shipyard conjunctivitis," or the more technical name of "epidemic keratoconjunctivitis." While most of the other types of acute conjunctivitis clear up in a week or ten days, this type lasts from three to four weeks and the blurring lasts much longer. It has been prevalent in many of the industrial plants on the Pacific coast and in the New York area. Many cases are also seen in New York City. Since this conjunctivitis has been so widely "glamorized," perhaps we should spend a little time discussing it. It frequently starts suddenly with a sensation of a foreign body in the eye. This is followed by swelling and marked burning and smarting of the eye. Often there is much pain. Nearly always there is a tender lump in front of the ear and the individual feels as if he is "coming down with the 'flu.'" There is rarely any pus coming from the eye, but the tears "run in a steady stream." The general symptoms last only a day or so, but the swelling and eye symptoms gradually increase in severity until about the fifth day, when the eye starts getting better. Then the blurring of vision begins. The eye is swollen and the blurring goes on for three weeks or so. During this time the eye looks nearly normal, but the blurring persists. This conjunctivitis is caused by a virus which was recently isolated by Dr. Murray Sanders, in New York City. While epidemic keratoconjunctivitis is a severe disease, the number of cases is inconspicuous as compared to acute conjunctivitis from other causes.

Conjunctivitis Caused by Filtrable Viruses

Since we have mentioned that this disease is caused by a filtrable virus, perhaps we should include a few other types of acute

conjunctivitis caused by viruses. As you all know, children with chicken-pox, measles, and three-day measles frequently have acute conjunctivitis. This conjunctivitis is produced by the same virus that causes the disease. Measles produces the most troublesome type, which usually requires treatment. The virus of measles causes the membrane of the lid to swell and become covered with little firm bumps called "follicles." These follicles may persist for quite a long time and frequently require treatment after the general disease has run its course.

Another interesting acute conjunctivitis caused by a virus is sometimes called "swimming-pool conjunctivitis" because many individuals contract the disease after going swimming in a pool. The methods by which the swimming pools become contaminated by the virus are rather involved and too lengthy to discuss now, but suffice it to say that as long as the water is chlorinated or constantly changing, the danger from the virus is slight. Nearly every year, however, we see a few cases of this disease.

Allergic "Pink Eye"

Most of us are familiar with hay fever and asthma and we know that these diseases are called "allergies." An allergic "pink eye" also occurs. This conjunctivitis is caused by a number of agents that may include food you eat, your fur coat, or perhaps the horse you ride. The itching is often intense. There are many other causes. Perhaps an allergic conjunctivitis due to oranges or tangerines may develop. The most frequent type, however, is a conjunctivitis that develops following use of mascara or other eye make-up. Hair dye is another important cause of allergic conjunctivitis. Edema of the lids and intense itching are the most outstanding symptoms. Many times it is very difficult to find the cause of an allergic conjunctivitis and the individual who has it frequently can suggest possible causes.

Prevention of Conjunctivitis

Before considering treatment, a few words concerning the prevention of conjunctivitis are in order. A very good rule to follow is "keep your hands away from your eyes." If you want to rub

your eyes or try to get something out of them, wash your hands with soap and water first. Our hands are always contaminated with many bacteria and, although the eye has a rather good resistance to help destroy these bacteria, many of them get into the eye, where they give rise to a conjunctivitis. If your eyes are normal, avoid washes and drops to keep the eyes clear. Nature has adequate means of keeping the eyes clear and bright. It is well to avoid used or dirty towels to wipe the eyes, since these are many times also contaminated.

Whenever people talk, sneeze, or cough they emit from their mouths thin bits of moisture called droplets. These droplet infections are important not only to the eyes but also the spread of upper respiratory infections. In crowded conditions it is difficult to avoid droplet infections, but one should try to avoid getting droplets into the eyes. If droplets do get into the eyes, frequent blinking may be of value in removing the infectious particles.

Treatment of Conjunctivitis

In considering the treatment of acute conjunctivitis, perhaps we should preface this part of the discussion by saying that your physician can give you valuable advice as to the best ways of handling your particular kind of conjunctivitis. He may prescribe the use of the sulfonamide drugs, for instance. These drugs have been of value in most of the bacterial types of conjunctivitis, but not in most of the virus forms, which require other types of therapy. While it is not possible to generalize on treatment of "pink eye," two home remedies are of value: these are a solution of boric acid and sterile white vaseline. A fresh, warm solution of boric acid used as an eyewash will remove much of the débris and crusts formed on the eyelids, and vaseline applied to the lids will prevent their sticking together and will soothe the inflamed membranes until more specific treatment from your physician can be obtained.

Iced compresses may add to the patient's comfort. Of course, ice should not be placed directly on the eyes, but cloths wrung out of ice water should be applied as compresses. They should be applied to the closed lids for 15 minutes to an hour, two or three times a day.

Summary

"Pink eye" is usually a simple disease, but may become quite serious. It occurs in adults as well as children and is caused by bacteria, viruses, or allergies. It is best to consult a physician whenever eyes become red and inflamed.

There are other causes for red and inflamed eyes than acute conjunctivitis. In an acute inflammation on the inside of the eye the eye may become very red. This simulates an acute conjunctivitis and requires vigorous treatment on the part of your physician.

The Vocational Training Program for the Visually Handicapped in the Minneapolis Public Schools

Kathern F. Gruber

THE author makes practical suggestions which have worked out in her community.

THE vocational training program for the visually handicapped in the Minneapolis public schools is called Applied Industries. It was initiated in 1935 under the inspirational leadership of Mr. George F. Meyer, then Supervisor of Sight-Saving and Braille Classes of the Minneapolis Public Schools. Prior to that time all visually handicapped pupils, upon graduation from high school or upon reaching the age of sixteen and no longer attending school, were clients of the State Department of Vocational Rehabilitation. They received their vocational adjustment through the Minneapolis representative of that Department.

Because of the lack of vocational opportunities suitable for the visually handicapped in the regular high schools, most of these pupils were graduated with a purely academic record. There was little or no available information concerning their vocational skills, interests, or aptitudes. It is needless to say that the majority of them became embarrassing responsibilities for the local rehabilitation office. It therefore became increasingly necessary for the sight-saving department to give consideration to vocational education.

Vocational training while the pupil was still in high school offered a possible solution to a very complex problem. Consequently a plan was worked out with the curriculum department of the Minneapolis public schools whereby 12th grade visually handicapped pupils might receive two vocational credits each semester for fifteen hours per week of supervised training in industry, such

credits to be applied toward high school graduation. A program was developed by which 12th grade pupils who chose applied industries as part of their last year of work in high school would be enrolled in an academic high school sight-saving class for half a day, and would be engaged in a supervised training program in industry the other half.

To implement this program, the sight-saving department selected one of its qualified high school teachers to serve as vocational co-ordinator for the applied industries pupils. It was agreed, however, that the State Department of Vocational Rehabilitation through its state vocational counselor for the visually handicapped would assume further vocational adjustment of these visually handicapped pupils if, after graduation from high school, their employment problems were still unsolved.

Selection of Applied Industries Candidates

Toward the close of each semester the sight-saving department makes special contact with all 11-A pupils enrolled in the sight-saving classes of the city to determine the placement of those who select higher education, those choosing applied industries and those dropping out of school at the age of sixteen. For those selecting applied industries a special day is set aside for conference with the consulting ophthalmologist. Present at this conference are the pupil, the director of special education, the state agent, the co-ordinator and, of course, the ophthalmologist. The ophthalmologist reviews the medical record of the pupil, giving detailed information regarding diagnosis and prognosis with references to visual acuity, depth perception, muscle balance, accommodation, fields of vision, and color vision, in their relation to industry. Pertinent questions of those present are answered by the ophthalmologist. If it seems desirable, a private conference is arranged between the pupil and the ophthalmologist so that the reasons for deleting any unwise undertakings may be discussed.

The consulting psychologist from the child study department next develops a guidance case study of the candidate. The director of special education places at her disposal the accumulated records of each pupil. The records consist of:

1. Complete, up-to-date ophthalmological record.

2. Complete, up-to-date physician's record. (Sight-saving class pupils are examined by a special school physician twice a school year.)
3. Family history record.
4. Attendance record.
5. Academic record.
6. Records of intelligence tests and achievement tests previously given.
7. Summary ratings on personality and adjustment of the pupil made by the sight-saving class teachers.
8. Notes on pupil's participation in extracurricular activities, school participation, etc.
9. Records of home visits made by the visiting teacher assigned to the department of special education.

The psychologist outlines a battery of tests to be given to each candidate. The tests for 1943 are as follows:

I. Intelligence Tests (one or more of these, depending on those given previously in the child's school career)—
   A. Stanford-Binet Intelligence Test.
   B. I.J.R. Intelligence Examination for the Visually Handicapped.
   C. Otis Self-Administering Test of Mental Ability—Higher Examination—Form B.

II. Stanford Achievement Tests.
   A. Reading Tests—
      1. Paragraph Meaning.
      2. Word Meaning.
      3. Language Usage.
      4. Dictation-Spelling.
   B. Arithmetic Tests—
      1. Arithmetic Reasoning.
      2. Arithmetic Computation.

III. Interest Inventories—
   A. Minneapolis Public Schools Interest Blank.
   B. Minnesota Mechanical Abilities Interest Analysis.
   C. Brainard Specific Interest Inventory—Form N1.
   D. Kuder Preference Record.

IV. Minnesota Manual Dexterity Test.

V. Cowan Adolescent Personality Schedule—Revision No. 2.

The Binet Test, the I.J.R. Test, the Dictation-Spelling, and the Minnesota Manual Dexterity Test are all administered by the consulting psychologist from the child study department with whom each applied industries candidate has a specified conference period. All the other tests are in Clear Type and are administered to the pupils by the respective sight-saving class teachers.

All tests are scored by the psychologist and the interpretations are recorded in the Guidance Case Study. When the psychologist has assembled and considered all records, a conference is called by the director of special education, at which the consulting psychologist gives each participant a copy of the summary she has developed and interprets her findings. At this conference tentative vocational plans are made for the pupil. The co-ordinator then assumes full responsibility for the program.

Duties of the Co-ordinator

The first duty of the co-ordinator is to present to the pupil the tentative training plans drawn up for his consideration. He then has the opportunity of making a choice of the one he would like to follow. The co-ordinator must then clear with the ophthalmologist in order to be sure that the vocation selected is a suitable one. The parent is next called upon to join the conference and the functioning of the plan chosen is explained. Emphasis is placed upon the seriousness of the obligation assumed by the pupil in entering upon the training program, and the obligation of the parent in maintaining home co-operation to implement the satisfactory fulfillment of such obligation. It is essential that the pupil and his parents understand and fully approve the training program selected.

In formulating plans, the co-ordinator must have in mind the following general policies governing the selection of training objectives as stated by the Minnesota Division of Rehabilitation in 1941:

> It is basic to the theory of rehabilitation in the competitive economy of today that the handicapped person should be guided to the selection of training for an occupation in which he will be able to do work of quality and amount equal to that of the average worker having no physical handicap.
>
> Training provided by the Division must in all cases have a definite vocational objective that can be attained within a reasonable time.

The training objective should be in harmony with the individual's abilities and physical condition. Sufficient evidence must be submitted to support the selection of the training objective.

The objective must be a legitimate, recognized occupation.

The objective must be one from which the client will not be barred by legal or other restrictions because of the type of his disability or inability to meet the established minimum requirements.

Training is most effective when it operates upon the principle of multipotentiality and versatility. That is, in the selection of training, the counselor should not overlook the advisability of preparing the individual so that he can adapt to many different jobs requiring similar skills.

It is required that the counselor, in selecting the type of training to be provided, will adhere to the principle of selecting such training as will prepare the client for employment in the shortest possible time and at the most economical cost consistent with adequate preparation.

Training that does not prepare specifically for a definite type of employment cannot be included.

Rather than establish arbitrary lengths of training periods for each employment objective, each training program should allow a period of sufficient length to provide adequate preparation for the employment objective selected. Long, drawn-out periods of training which defer entrance into remunerative employment should be avoided and discouraged. The counselor is expected to determine the length of the training period and to make recommendations accordingly.

The co-ordinator is responsible for the selection of co-operating agencies. She therefore canvasses the resources within the community, listing all possible firms, industries, etc., that may be called upon to co-operate. She confers with the president of the firm selected, outlines the objectives of the training program, and explains the functioning of it during the school year, emphasizing the following salient points:

Pupil to train three hours every school day, time of training to be adjusted to wishes of co-operating firm.

Pupil to receive two vocational credits for this training.

Pupil to receive no monetary remuneration.

Pupil not to replace a regular worker.

Co-ordinator to make weekly calls for supervisory purposes; to relieve co-operating agency of any serious difficulties that may arise during the training period; to clear any misunderstandings with respect to insurance rates (see Appendix I); to clear any misunderstandings with respect to the existence of a contract between the co-operating training agency and the trainee; to clear the case with the respective labor unions involved.

The co-ordinator is further responsible for checking the physical set-up of the plant for optimum working and lighting conditions.

After all such preliminary steps have been taken, the co-ordinator works with whatever personnel the president of the company assigns for the particular undertaking.

All of the preceding preparations are completed before the beginning of the 12th school year. If that occurs in mid-year, the co-ordinator has individual conferences with the pupil during the closing week of the 11A grade. If the semester begins in September, the co-ordinator holds such conference the week before school opens. This co-ordinator-trainee interview serves as the starting point for an entirely new type of work for the trainee; it gives the co-ordinator an opportunity to (1) review and stress the objectives of the course and the obligations of the trainee to the co-operating agency, to his own welfare and to the welfare of the entire group of the visually handicapped; (2) interpret the operation of the training program to the trainee; and (3) establish an acceptable time and place for necessary conferences during the training period.

After each program is launched and the pupil is reporting for supervised training for three hours every school day, the co-ordinator acts as liaison officer between the school and the co-operating agency. This work is extremely important and must be carried out with regularity. Usually the co-ordinator makes a call on the co-operating agency once a week and does all in her power to assure smooth functioning of the program. During such visits she obtains suggestions for possible improvement of individual programs; checks on validity of trainee's possible complaints; smooths out any difficulties in a businesslike manner; obtains report card marks for trainees, such marks to be arrived at with the co-operation of the immediate superior in charge of trainee.

The co-ordinator must also maintain the intelligent goodwill and co-operation of the agency by occasional courtesy calls on the executives or by dispatching letters. She must survey industries and firms not as yet co-operating with the program to discover possibilities for future co-operation and to lay the groundwork for such co-operation. At the close of the training period she must endeavor to place all Applied Industries candidates who have completed their training programs and who have satisfactorily demonstrated their ability to produce on a par with their normally sighted co-workers. Usually they are employed by the co-operating firm but, if not, the co-ordinator advises them concerning applications for work at similar firms or industries. If trainees are unable to obtain employment within three months after the completion of their training program, the co-ordinator presents the matter to the state agent and the case comes up for review by the State Department of Rehabilitation, whose clients they then become.

The co-ordinator co-operates with the state agent in the review of such cases and in the development of further vocational adjustment for them, and maintains follow-up work on all Applied Industries cases.

The co-ordinator makes periodic reports to all sight-saving class teachers with respect to the Applied Industries cases. In such reports it is helpful to point out those factors that made for distinct success in some instances and those that made for failure in others. This type of report (without use of names) gives the sight-saving class teacher concrete material to use with her respective grade group in developing the supplementary and necessary assets for successful vocational adjustment.

The Sight-Saving Class Teacher and an Effective Vocational Program

It is evident from the foregoing that the teachers of elementary and high school sight-saving classes have a definite responsibility for vocational guidance. It is not enough for a sight-saving class teacher to see that her pupils develop average attitudes, habits, and skills. The working world will not change to conform to the needs of a handicapped group; the teacher must be constantly on the alert to imbue each pupil with habits of eye care so that they

will become second nature to him; she must also place emphasis upon:

1. Punctuality in keeping all appointments.
2. Regularity in attendance. (This implies special reference to the maintenance of good health.)
3. Courtesy.
4. Moral maturity—carrying out assigned instructions; finishing a piece of work within a prescribed time; asking for no concessions; maintaining standard production in school work, etc.
5. Independence in coming to and from school. (One of the primary requisites in holding a job is the ability to go to and come from work alone.)
6. Responsiveness to the group—making contributions to the group; giving assistance to others; asking advice for himself; avoiding repetition of mistakes; being agreeable and pleasant to associates; identifying his own good with that of the group as a whole.

The teacher must select handwork of such a nature that the processes entailed are valuable and that the finished product justifies the time, labor, and materials involved. She must see that her pupils participate with the regular grades in cooking, housecrafts, elementary wood and metal work and gardening. She must give special consideration to typewriting as a tool that is a definite asset in many occupations. The co-ordination learned in the mastery of the typewriter is often a factor in maintaining hand and finger dexterity in other jobs.

Since physical poise is a tremendous vocational asset, it is imperative that the sight-saving class teacher encourage its development. Because participation of the visually handicapped in normal physical education programs is often limited because of eye conditions, the special teacher must help each pupil overcome any physical difficulties and develop poise to the optimum of his ability. To be able to speak and to listen well is an asset to anyone; to a visually handicapped person it may be the passport to employment.

Personality and grooming are often deciding factors in the selection of employees; the visually handicapped person cannot afford to add to his handicap by being slipshod in his personal appearance or his habits. The sight-saving class teacher must be frank with

her pupils in the discussion of these matters. Group and individual approach may be necessary. Each age group responds to different types of suggestions. By the time a pupil is ready for applied industries he should be thoroughly conscious of the vocational value of good grooming and his own ability to correct personal faults.

It is extremely desirable to have the visually handicapped pupil understand the effect of his own successes or failures on the employment of other members of the group. Whatever he does, good or bad, is quickly applied to all the visually handicapped. By his actions he can bring opprobrium or approval to the whole group.

Community Obligations

In the final analysis, a vocational program for the visually handicapped is definitely tied up with the larger problems of general employment, workmen's compensation, accident prevention, and social insurance. The public usually supports that which is indispensable, hence a conscious development of sound public opinion is of tremendous importance in the effective functioning of a vocational training program for the visually handicapped. All sight-saving class administrators, teachers, pupils, and parents of pupils have a community obligation to such development. General educators as well as PTA groups, community agencies, clubs, employer and employee groups, need to be informed of the problems and of their responsibility for solving them. The press, the radio, and moving pictures have a tremendous power to sway public opinion, hence care must be exercised that sensationalism be avoided and that a sound, practical viewpoint be expressed.

Acknowledgments

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M. Kathryn Morse, Visiting Teacher assigned to Special Education, Minneapolis Public Schools.

All sight-saving class teachers in the Minneapolis public schools.

APPENDIX I

Anti-Discrimination Act (Chapter 367, Laws of 1919)

An act making it unlawful to discriminate against handicapped persons through workmen's compensation insurance rates and providing a penalty.

Be it enacted by the Legislature of the State of Minnesota:

Section 1.—No person, partnership, association or corporation, or their agent or employees writing workmen's compensation insurance in this state, shall make or charge any rate which discriminates against the employment by the insured of any person who is physically handicapped by reason of loss or loss of use of any member due to accident or other cause.

Section 2.—Any person, partnership, association or corporation, or their agents or employees, offering a rate of compensation insurance forbidden by Section 1 of this act shall be guilty of a misdemeanor.

Section 3.—Whenever any company or its agents or employees shall have been convicted of a violation of this act, such fact shall be sufficient cause for the cancellation of its license by the commissioner of insurance.

Section 4.—This act shall take effect and be in force from and after its passage.

Approved April 23, 1919.

Liability for Second Injury (Chapter 43, Special Sessions Laws, 1935. Effective January 19, 1936).

Mason's Minnesota Statute 4276.—If an employee receives an injury which of itself would cause only permanent partial disability, but which, combined with a previous disability, does in fact cause permanent total disability, the employer shall only be liable for the permanent partial disability caused by the subsequent injury.

Provided, however, that in addition to compensation for such permanent partial disability and after the cessation of the payments of the prescribed period of weeks, the employee shall be paid by the state the remainder of the compensation that would be due for permanent total disability, out of a special fund known as the Special Compensation Fund . . . .

APPENDIX II.—GUIDANCE CASE STUDY

Examiner: Psychologist
Child Study Department
Minneapolis Public Schools

Subject: 9

Date: 4–18–39

Age: 18 Sex: F.

Revised Stanford-Binet, Form L: C.A. 18–3, M.A. 17–4, I.Q. 115. Rating, high average ability. Subject's rating on all items requiring abstract reasoning ability was exceptionally good. Memory and vocabulary development likewise seemed to be very good.

Stanford Achievement Test:		*Educ. Age Equiv.*
Paragraph Meaning	16–10	
Word Meaning	15– 9	
Average Reading		16–5
Spelling-Dictation	15– 0	
Language Usage	17– 0	
Arithmetic Reasoning	17– 6	
Arithmetic Computation	15– 2	
Average Arithmetic		16–3
Average Achievement		16–5

Minnesota Manual Dexterity Test:

Hand rate of manipulation—Performance surpassing 75 per cent of the adult population.

Finger rate of manipulation—Performance surpassing 73 per cent of the adult population. These ratings are significantly high when one considers that no allowance was made for patient's visual difficulty.

Minnesota Aptitude Test for Clerical Workers: Patient's vision was found to be too deficient for the administration of this test to be continued.

Bernreuter Personality Inventory:

Self-confidence Scale.—20th %ile in self-confidence, indicating a marked aggressive tendency.

Sociability Scale.—38th %ile in sociability, indicating a tendency to prefer group activities to solitary pursuits.

On this test patient indicated that she likes to bear responsibilities and would rather work for herself than for a superior. She can stick to tiresome tasks for long periods and feels she can take criticism with good grace. Patient does not consider herself nervous or lacking in confidence. She enjoys social contact with other people, particularly with younger children.

Minneapolis Public School Interest Blank and *Minnesota Mechanical Abilities Interest Analysis:*

General Activity Preferences.—Patient enjoys taking care of young children. She likes cooking and helping about the home. She has had considerable experience in household activities. At the present time she is working for her room and board and her duties consume much of her time outside of the regular school day. She is a sociable girl and enjoys parties, and meeting new and interesting people. She is deeply interested in religion.

School Subject Preferences.—Patient enjoys academic work. English, mathematics, physiology, hygiene, typing, and physical training all appeal to her. No particular abilities or aptitudes are revealed by her preferences.

Reading Interests.—Although patient's reading is curtailed, she enjoys stories of home life and adventure, the Bible, and housekeeping books. She dislikes detective stories.

Three Wishes.—(1) I wish that I could be able to give my parents everything they sacrificed for me. (2) That I may be able to speak correctly. (3) That I may be one of the best in whatever I study or whatever work I do.

Occupational Preferences.—(1) Social service work; (2) caring for orphan children; (3) legal work.

Vocational Interests.—In addition to the above occupational choices patient is interested in playground direction and the work of a YWCA secretary.

Additional Information

Degree of Visual Defect.—Patient's eye difficulty has been diagnosed as myopia with high myopic astigmatism. Her most recent examination revealed vision of 6/15–2 and 6/15–3 in the right and left eyes respectively when glasses are used. Visual difficulty has not been under observation long enough to determine whether her case is progressive. However, her difficulty is serious and the ophthalmologist recommends that close eye work must be limited.

Family Situation.—Patient is the youngest of six children. Her father runs a large farm. Her mother is ill and the family has had a great deal of medical expense over a period of years. There is a good family background. The financial resources are somewhat limited.

School Grades.—Patient previously attended a convent school, and was much discouraged when forced to remain at home for two years because of her visual difficulty. During the past year and a half she has been attending high school; her academic record has been average or somewhat above average.

Health History.—Other than her visual difficulty, patient's health has been quite good. Teeth poor.

Interview.—Patient is an attractive girl with a clear complexion. She is neat, friendly, self-reliant, and well mannered. She has an amiable friendliness and readily adjusts to other people. She has a great deal of animation and sparkle, making her interesting to others; she in turn is interested in finding out as much as she can about those with whom she comes in contact. From the standpoint of physical appearance and easy sociability, she should have little difficulty in getting on with people and should be successful in jobs requiring social contacts.

Until very recently patient had planned to attend the university. Her aspirations are high and she seems to have a great deal of motivation for success. She recognizes that financial resources of her family are limited and would prefer to be personally responsible for the expense of further training. She has a close attachment to her family and is hopeful that she and her next older brother will be able to bring her parents to the city to live permanently. The fact that her mother is ill and that both of her parents are quite old makes it difficult for them to remain on the farm.

Ever since she was eight years of age patient has aspired to become a lawyer and this interest has waned only within the last few years. She now has quite a pronounced urge for personal service which appears to be bound up with her religious interest and desire to serve other people. The appeal that social service has for her consists in the opportunity it would give her to do things for others. Her fondness for younger children has led her to consider doing social service work for orphans.

Patient is now entering Applied Industries because she realizes that it would be better for her to become financially independent as soon as possible. She hopes eventually to get further educational training and may enter the university when she has accumulated some money.

Psychological Summary.—Patient is a very attractive girl with

high average intelligence (Stanford-Binet I.Q. 115) whose academic record has been at least average and who has good motivation for success. In personality she is sociable, friendly, and well liked. Her desire for personal service is intimately bound up with a religious and altruistic ideal.

Tentative Placement Plan.—Patient's desire to enter social service or some allied field of work should be definitely encouraged. Her appearance and her easy sociability should make for success in a job stressing personal relationships. It is possible that some of the courses in the Junior Nursing sequence would give her a good background in child care and training, home nursing, and nursery school work. Placement in some children's home or work as a nursery school assistant in a settlement house might be arranged.

Report of the Vocational Co-ordinator—Subject No. 9

The Vocational Training Plan submitted for Subject No. 9 was one of Junior Nurses' Training with the local Vocational High School as the co-operating agency. Subject attended two related-trade-information classes each week at the Vocational School and was assigned to actual duty at one of the Settlement Houses each afternoon. This schedule continued for half a year. Because of the subject's expressed interest in assisting other handicapped persons, the co-ordinator arranged for subject to work for half a year with the kindergarten teacher at the local school for crippled children.

Subject proved eminently satisfactory and was recommended for placement before the school year was over. Immediately upon graduation subject was employed in a fine home as governess to two pre-school children, which position she kept for a year. Her next position was as governess to a home-bound child. Subject accomplished her work in a superior manner. Lure of better wages has drawn her into defense work at the present time. However, she plans to continue her professional study in Junior Nursing as soon as she has the necessary time and money.

The Forum

THIS section is reserved for brief or informal papers, discussions, questions and answers, and occasional pertinent quotations from other publications. We offer to publish letters or excerpts of general interest, assuming no responsibility for the opinions expressed therein. Individual questions are turned over to consultants in the particular field. Every communication must contain the writer's name and address, but these are omitted on request.

When a Child "Fails" the School Vision Test*

In thousands of schools throughout the country, teachers give their pupils periodic vision tests to screen out the children who are less able than others to see to do their work. Of course, the tests are simple and not particularly discriminating, but they serve a very worth-while social purpose in detecting at least the more severely handicapped pupils. Some schools have on the staff an eye doctor who examines each child thoroughly at certain specified times, but in the many schools where this arrangement—undoubtedly the best—is not possible, various screening tests are used.

Probably the most familiar is the Snellen test, in which the child reads letters of different sizes from a card twenty feet away. In recent years this test has been shown to be inadequate† because it fails to detect some of the troublesome eye conditions which handicap school pupils. More discriminating tests have been devised by various persons, and their use is constantly growing more widespread as school authorities realize the importance of efficient seeing among pupils who are expected to carry on the work of the modern curriculum.

Among these tests are the Betts Visual Sensation and Perception Tests (Keystone View Company, Meadville, Pennsylvania); Eames Eye Test (World Book Company, Yonkers-on-Hudson, New York); Jensen Test of Color Blindness, Visual Acuity and Astigmatism (Psychological Corporation, New York City); Visual Fitness Test (E. P. Leonard, Jr., Newton, Massachusetts); and the Massachusetts

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† See reference list at the end of the article.

Vision Test (Division of Child Hygiene, Massachusetts Department of Public Health, Boston, Massachusetts).

Most teachers gladly co-operate in making the vision tests because they understand the importance of good sight to the academic future of the pupils, but some regard the program as an unnecessary task imposed on the already overworked teaching staff. It is, of course, trying to have to interrupt the teaching program, even briefly, especially when supervisors are setting a rapid pace; but it is also discouraging to try unsuccessfully for months to teach Joe to read or to do arithmetic, only to find at last that the letters, digits, words, sentences, and problems so painstakingly shown and explained to him have been seen only as shadowy or distorted marks on the page.

As long as their particular children "pass" the vision test, most parents either approve or are indifferent to the testing of the eyes at school. If, however, the familiar little slip comes home with its message that Margaret should be taken to the eye doctor, there is a prompt parental reaction. Intelligent parents usually appreciate the information and take the child to the eye specialist at once. Others find it impossible to believe that anything could be wrong with *their* child, and they resent the implication that there may be. Some become panicky about possible retributive consequences of not doing as the slip requests, especially if there is attached a section to be signed by the parent and returned to the school by the parent or doctor. Others, through sullenness or indifference, disregard the notice completely. Many of those who are rather irked by the notice eventually consult an oculist or optometrist and, when he finds the child's eyes in need of attention, come to appreciate the solicitude of the school.

When a child fails to "pass" the vision test, teachers and parents usually think of glasses as the probable result of a visit to the doctor. All are reasonably satisfied if the child returns to school with a pair of spectacles and proceeds to earn higher marks. Teachers and parents usually believe that, when glasses have been prescribed for a child, his vision is fully normal while he wears them, and they expect him to compete on equal terms with pupils who have no eye trouble. Many times he cannot do so because even the most skilfully fitted glasses will not raise his vision to normal, although they may improve it appreciably. When there is disease or deficiency in the tissues of the eye, glasses are not likely to help very much because they merely serve to put the eye in focus and cannot affect its sensitivity.

Many children with eye trouble do not need glasses. They may need rest, medical treatment, or or-

thoptic exercises. Teachers hear a lot about eye exercises and may be misled by overenthusiastic reports of their efficacy. Briefly, there are two types of such exercises, which may be termed "legitimate" and "illegitimate."

Legitimate exercises, or those of proved worth, are usually directed toward teaching the eyes to see more discriminatingly, teaching the eyes to work together, or teaching the mind to combine into one picture the two single pictures sent back to it—one from each eye. Such exercises are employed by reputable eye physicians and optometrists.

Illegitimate eye exercises are those of the "throw-away-your-glasses" type. They are usually fantastic, have catchy names, and are based on half-truths and an incomplete understanding of the facts of physiology and psychology. Often they may afford immediate temporary improvement in vision regardless of the train of unfavorable consequences which results from the muscular spasm, photochemical depletion, and other undesirable physical changes which they set up. Some of the exercises are dramatizations of simple little involuntary acts which the eyes perform anyway without study of a series of "lessons." No conscientious oculist or optometrist wishes to put glasses on any patient; he will use every means in his power to avoid doing so if any such possibility exists. Neither will he inconvenience his patient with exercises unless there is some likelihood that they will benefit the condition for which treatment is sought.

Sometimes a child who has "failed" the school vision test returns to the teacher with a brief statement from the doctor that glasses are not needed. The teacher wonders why. Sometimes the reason is that the school test was made during a study period or immediately after the pupil had been doing very close book or desk work. In some such cases, especially if the pupil is inclined to be nervous or tense, the focusing muscles in the eye will not fully relax and the child will be artificially nearsighted for a few minutes or perhaps half an hour or longer. Such a child will be likely to "fail" the vision test but may have relaxed more fully by the time he sees the doctor. Other children have insensitive eyes, the part that sees being like the old, slow camera film as compared with the newer speed films. In such cases glasses may be of no value, and the doctor may think it best to approach the problem of treatment in a different way. Sometimes there are blind spots in the eyes. Part of the eye will be able to see while the remaining part may not. This condition, again, is not helped by glasses, and in such a case the child will return from the doctor without them. Misunderstandings are bound to occur when busy teachers and busy doctors do not take time to

explain fully or to confer when questions arise. Most doctors are glad to explain such matters to teachers.

When a child has low vision which is only partially improved by glasses or which cannot be improved at all, the teacher should not expect the pupil to compete with normally seeing children. He should be given a seat in a good light, be given frequent rest periods, be permitted to look out of the window whenever he wants to (because looking out of the window rests the focusing muscles), and be provided with textbooks having large, boldface type. He should be allowed to use a heavy, soft pencil, and to write script large enough for him to see clearly. If vision is markedly low, placement in a sight-saving class should be considered.

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More About Eye Exercises *

Pascal's proposal (*American Journal of Ophthalmology*, 1943, volume 26, June, page 636) that the "Bates system" should be made the subject of research by a university eye clinic is not very likely to meet with general approval, and will perhaps be scorned by many ophthalmologists. Pascal, we note, recommends that Huxley's book on the "Art of seeing" "be taken more seriously by ophthalmologists than it apparently is"; because, although "a great deal of the 'science' in Mr. Huxley's book is pseudoscience," yet there may be "some points in the Bates system which are sound and which can be used with advantage, . . . as an adjuvant to the correction of refractive errors."

A personal letter from another colleague suggests that to call the method under discussion "unscientific and absurd, which to be sure it

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is, is perhaps too negative an approach," and that "a more positive approach would be to recognize what modicum of truth there may be in the claims"; further that it would be "sounder to assume that there is nothing the Bates school knows which we ophthalmologists do not know and apply when the situation requires it."

The same correspondent reaches the general conclusion that "there is nothing to investigate in the Bates method, but we can afford to be less harsh and more benevolent in our reaction to it, and treat the clients of it with more sympathy and understanding of their problems."

It has been hinted that the subject will be discussed before at least one of our national societies and also before an important local organization. It may therefore be well to consider on the one hand what circumstances have favored the Bates movement and have promoted its popularity among certain members of the community; and on the other hand what "modicum of truth there may be in the claims" made by Bates and his successors.

The attempt to escape the use of spectacle lenses, in cases where ophthalmologists are disposed to recommend them, is sometimes merely an aesthetic or psychologic manifestation. The individual, regardless of other considerations, is willing to do almost anything to avoid what he regards as the disfigurement and the annoyance of having to wear these "crutches," as Aldous Huxley likes to call them. This group of individuals does not need to concern us greatly. "He that complies against his will is of his own opinion still."

Huxley himself belongs to another group, small but relatively important—those who, as the result of serious ocular disease (such as Huxley's adolescent keratitis punctata) can never hope to obtain perfect vision, even by the aid of correcting lenses. Some of these sufferers wander, as Huxley seems to have wandered, from one eye expert to another, vainly hoping for good sight, and at times, no doubt, losing rather than gaining by the effort of the ophthalmologist to find satisfactory correcting lenses.

A third group, intermediate in numbers and significance, yet sufficiently important during the war emergency, consists of those candidates for special classification in the Army, the Navy, the Marines, or the air services who are disqualified on account of refractive or muscle errors, and who insist on finding some means, other than spectacle lenses, which will enable them to qualify.

Numerically very much the most important class is that of the patients who need correcting lenses but have never succeeded in finding the proper refractive measurement, the proper muscular adjustment, or the correction for an unrecognized

aniseikonia, or the necessary combination of all three.

For driving this last group into the hands of the Bates school the responsibility lies with ophthalmologists and optometrists—more frequently no doubt with the latter than with the former, yet all too frequently with the ophthalmologist.

How often we see patients who have apparently struggled year after year, from one optometrist to another and then to an ophthalmologist, or from ophthalmologist to ophthalmologist, or occasionally from ophthalmologist to optometrist, wearing prescription after prescription with which they were never comfortable, and who yet were in the last analysis capable of proper correction. In desperation, and grasping at the proverbial last straw, some of these patients pass into the hands of the Bates practitioner, honest or dishonest.

Every overcorrected myope, every myope whose two eyes are not properly balanced, or who has an inaccurately measured astigmatic error, is a potential candidate for the Bates system. The same is true of many uncorrected hyperopes, especially if subjected to the annoyance of poor balance or astigmatic imperfections; and it is of course equally true of the patient in whom astigmatism is the chief source of trouble but who has never received the right strength and axis of cylinder for each eye.

The existence of the Bates school may be blamed in large part on chaos and neglect in the teaching and practice of refraction; and the most important remedy for the activities of the Bates school is to be had from systematic improvement in refractive technique. Nor should it be forgotten that an important part of refractive technique lies in the proper adjustment of frame and lenses, and that a good refractive diagnosis may be spoiled, so far as the result to the patient is concerned, by neglect as to centering and angling of the lenses or as to their distance from the eyes.

If the patient, through imperfect work, has failed to obtain comfort with his glasses, he may the more easily be persuaded that glasses are harmful and that he can be made more comfortable without them.

The candidate for war service, having a very practical reason for demonstrating ability to satisfy certain visual standards without glasses, is often a particularly easy victim of the most unscrupulous type of Bates practitioner. It is difficult to accumulate a body of substantial evidence as to what is going on with regard to these charlatans, but from time to time one hears of cases in which the applicant, after the use of "exercises," has gained a line or two on the Snellen chart and so has been able to pass an examination for the Navy or the flying forces.

It must be remembered that varying efficiency of illumination in dif-

ferent recruiting offices could play an important part as to conflicting results in successive examinations of the same candidate. But it is probable that even more important is the instruction of the applicant, by his Bates practitioner, in certain special maneuvers with which the applicant may learn to struggle a line or two further down the chart. Such tricks are not altogether honest, but the applicant does not necessarily realize the harm that might result from what is virtually a misrepresentation.

It was to be expected, and has actually occurred, that the improved vision thus shown would break down under pressure of active service. Visual standards in the armed forces are based upon considerations of safety and efficiency. The aviator who has a disturbing amount of hyperopia, or an important astigmatic error, or even a low myopia, may be able to improve his visual record under favorable physical conditions, or by certain efforts with the orbicularis and elevator muscles of the lids. But, in the presence of fatigue or difficult flying conditions, his basic visual defect may render him a source of danger not only to himself but to his comrades, to say nothing of the risk to valuable fighting machinery. Hence, what appeared to be gain is really loss, and what appeared a triumph for the Bates method may come dangerously near being rank treachery. Yet we are told that various Bates practitioners (chiefly among the less creditable group of optometrists) are regularly selling such "services" for substantial monetary considerations. It is as to this kind of trickery, in relation to the war emergency, that the most valuable results are likely to be obtained from well-organized research into the achievements of the Bates method. The "modicum of truth" concerning the "Bates system" will inevitably be found to include this sort of trickery. Such further results as it obtains depend, not upon any elements of truth in the physical claims of the school, but upon a combination of autosuggestion with certain universally recognized but less generally practiced principles of rest and relaxation.

In spite of the fanciful language in which they are often clothed, the so-called Bates exercises act chiefly to rest the eyes and to induce conditions of mental relaxation. The importance of the relationship between relaxation and activity is perhaps too frequently overlooked by physicians, including some ophthalmologists. Yet in writing on this theme, as well as in various other details, Huxley is guilty of several rather reckless misstatements. He says, for example: "Adequate cognition of the external world depends upon movement. . . . And yet for some inexplicable reason, orthodox ophthalmologists have never paid the smallest attention to it. The first person to devote any serious thought to this manifestly important problem was Dr. W. H. Bates."

He says elsewhere: "Orthodox ophthalmologists are content to palliate the symptoms of poor sight by means of those valuable crutches, artificial lenses. They work only on the sensing eye and ignore completely the selecting, perceiving, and seeing mind."

Many ophthalmologists expend a good deal of energy in warning patients to avoid excessive continuity of effort and to aim at bodily and mental relaxation, even during the performance of work. Much of Huxley's book is devoted to this very topic, and some of the most laughable forms of eye exercises recommended by Huxley and his teachers are simply systematic means of attaining relaxation. Good examples of this are to be found in Huxley's chapters on "palming," on "blinking," on "breathing," and on "swinging"; as well as in the general chapter on "relaxation."

Perhaps no better example of this pursuit of mental relaxation could be had than Huxley's description of "nose writing." (See quotation on this subject in the previous editorial, *American Journal of Ophthalmology*, February, page 200.) Readers will remember Huxley's dictum that "A little nose-writing, followed by a few minutes of palming, will do wonders in relieving the fatigue of a strained mind and staring eyes, and will result in a perceptible temporary improvement of defective vision. This temporary improvement will become permanent, as the normal and natural functioning fostered by nose-writing and the other procedures described in this book becomes habitual and automatic."

Huxley insists repeatedly on the fact, which might at first appear a trifle paradoxical, that relaxation is often best attained actively, under concentration, rather than passively and during a period in which the subject seeks to banish all definite thought from his mind. We are told to "work hard but never under tension," to "avoid being bored or boring others."

Not many of us would quarrel with the statement that "inhibition of the movement of the eyes . . . is brought about by too great a desire to see." The fatigue and strain that come from stagnancy in effort of any part of the body are familiar to us all.

Bates at first taught his clients to imagine black while palming (cupping the hand over the eye). But he later advised "remembering pleasant scenes and incidents out of (the patient's) own personal history." Huxley naïvely comments on the "refreshment in the temporary exclusion of light, and comfort in the warmth of the hands." He also advises that "where circumstances make it difficult or embarrassing to assume an attitude of palming, it is possible to obtain a certain measure of relaxation by palming mentally —that is, by closing the eyes, imagining that they are covered with

the hands and remembering some pleasant scene or episode." Many of our own very loyal patients, hard pressed at business or at recreational reading, have probably complied with Huxley's recommendation of "gentle rubbing of the temples . . . often . . . soothing and refreshing"; or would even agree that "eye fatigue may also be relieved by rubbing and kneading the muscles of the upper part of the nape of the neck."

It is not necessary to condemn any of a group of innocent pastimes recommended by Huxley and others. More or less, they are a part of common human experience. Thus Huxley advises juggling two bowls from hand to hand, or combining rapid fixation with the exercise of memory in the form of simple games with dice or dominoes.

But we are bound to disagree with Huxley and his predecessors, and sometimes to laugh at them, when, in treating of astigmatism, they indulge in such claims as that "spectacles tend to fix the cornea in that particular condition of distortion present at the moment of the oculist's examination. . . . But if the astigmatic person will discard his artificial lenses, learn the art of passive and dynamic relaxation, . . . he can do much to diminish, or even altogether eliminate his disability."

Duke-Elder well says (*British Medical Journal*, 1943, May 22, page 635): "Whatever be the value of the exercises, it is quite unintelligent of Huxley to have confused their advocacy with so many misstatements regarding known scientific facts. . . . The most stupid feature about his book, however, is that he insists throughout on the physiological mechanism whereby these exercises are supposed to work. It would at least have been logical if he had continued to allow the reader to assume that he was speaking in ignorance of anything except results. . . . For the simple neurote who has abundance of time to play with, Huxley's antics of palming, shifting, flashing, and the rest are probably as good treatment as any other system of Yogi or Coué-ism. To these the book may be of value. It is hardly possible that it will impress anyone endowed with common sense and a critical faculty. It may be dangerous in the hands of the impressionable who happen to suffer from glaucoma or detachment of the retina, and undoubtedly will be dangerous in the hands of the anxious parent of a myopic child. . . . But the greatest value of the book will be to the psychiatrist as an intimate and revealing self-study in psychology."

—W. H. Crisp, M.D.
Denver, Colorado.

Apropos of College Lighting

Editor's Note.—The correspondence which is published herewith between Dr. Winifred Ingersoll and

W. G. Darley of the Nela Park Engineering Department, General Electric Company, concerns the article by Dr. Ingersoll, entitled "Visual Acuity of College Students in Rocky Mountain State," which appeared in the Spring issue of the REVIEW.

Dear Dr. Ingersoll:

There is one point in your paper on the visual acuity of college students drawn from the Rocky Mountain area (SIGHT-SAVING REVIEW, Spring 1943, Page 53) which I would like to discuss. It is stated therein that "the causes usually given for near sightedness, thus, are inadequate to explain its prevalence among these students." This conclusion is based in part upon the thought that two-thirds of the 437 students questioned had always used electric light, i. e., always had good lighting, while one-third had used oil lamps, i. e., poor lighting.

While there is no question but that the *potentiality* for better artificial lighting exists in wired homes in much greater degree than in unwired homes, the fact remains that in relatively few instances has the maximum advantage been taken of this potentiality. The result is, I feel sure, that a meticulous investigation would reveal that lighting conditions in some of the wired homes are actually less satisfactory than in unwired homes where maximum advantage is taken of other than electric light sources.

In other words, it is not entirely safe to infer that all students from oil-lamp-lighted homes did homework under less favorable seeing conditions than students from wired homes, though on the average, it would be reasonable to expect this to hold. On the other hand, my knowledge of the lighting arrangements for study purposes in the average home in this vicinity leads to the conclusion that while in general better artificial lighting will be provided in the wired home than in the unwired home, such lighting will as a rule leave very much to be desired from the standpoint of the requirements of the visual tasks and of good lighting practice for ease of seeing.

The data which you have presented in the paper are most interesting. I am wondering if similar information is available on graduating students. The information presented by Ruth E. Boynton on the Minnesota students carried an analysis for both entering and graduating students, and it appeared to me that the case she presented was quite significant.

Very truly yours,

W. G. DARLEY

My dear Mr. Darley:

Thank you for your letter of June 26 with your interesting discussion of the paper. . . . Of the seven causes for low visual acuity mentioned, you question whether

enough importance has been attached to lighting, and it is quite possible that you are right. Much more study of that factor is needed before coming to a definite conclusion. I believe that lighting is somewhat poorer in Wyoming than in most areas. You state that electric lights are not often at maximum efficiency. Would not the same tendency to use inefficient electric lights exist wherever electricity is used, and would not any type of lighting system be below maximum efficiency in the average home? While it might be difficult to prove, I believe from observation that Wyoming students use lights less than most groups, which would in part at least offset the poorer lighting. That is one reason why I would search for other factors. Many freshman students gave 9 P.M. as their retiring hour, and movies are available only to those living in the larger towns.

I suppose there may be many things which are contributing in some degree to low visual acuity among these students. I cannot help thinking that there may be something of importance which is peculiar to this locality, such as altitude or some dietary deficiency. It will take more investigation to be sure. I appreciate very much your helpful criticism.

Very truly yours,

WINIFRED INGERSOLL, M.D.

Dear Dr. Ingersoll:

You are quite right in stating that the tendency to use inefficient electric lights exists wherever electricity is used, and that any type of lighting system is below maximum efficiency in the average home. In my letter of the 26th, my only thought was that conditions in Wyoming would not be very different from those in this vicinity, and that in this vicinity, artificial lighting, as a rule, leaves very much to be desired from the standpoint of the requirements of the visual tasks and of good lighting practice for ease of seeing.

Considering how poor home study and school classroom conditions are, generally, throughout the country, I would be somewhat surprised if those in Wyoming would be very far out of line. As a matter of fact, whether a student depends upon natural lighting or upon artificial lighting for his or her indoor study, the answer will be about the same unless the student has been educated to take maximum advantage of the available illumination. Thus, day-lighting even on bright days leaves much to be desired in the average classroom, particularly for those students seated at the inner row of desks. Of course, when it is necessary to pull the shades down, and on dark days, practically all individuals in the room are handicapped with a lighting deficiency.

Probably the best way to check

on this matter is to obtain an instrument which will measure illumination, such as a light meter, and actually measure the illumination at the work point in a number of homes and classrooms. While it is true that the quantity of light on the work plane bears no relation to the quality of the lighting (that is, freedom from direct and reflected glare, shadows, etc.), it is also a matter of fact that human beings are very poor light meters insofar as determining the quantity of light is concerned. On the other hand, with a little practice, one can soon learn to analyze whether or not a particular seeing condition is comfortable or not. . . .

Very truly yours,

W. G. DARLEY

Note and Comment

Dr. Lancaster to Receive Leslie Dana Gold Medal.—The Leslie Dana Gold Medal, awarded annually for outstanding achievements in the prevention of blindness and the conservation of vision, will be presented this year to Dr. Walter B. Lancaster of Boston—a member of the Society's Board of Directors.

Dr. Lancaster was named for this honor by the St. Louis Society for the Blind, through which the medal is offered by Mr. Leslie Dana of St. Louis. This highly prized token of recognition in the field of public health is given upon the recommendation of the Association for Research in Ophthalmology.

Despite his 80 years, Dr. Lancaster is in active practice as an ophthalmologist. He is consulting ophthalmic surgeon at Boston City Hospital, Massachusetts Eye and Ear Infirmary and Massachusetts General Hospital. He was formerly chief-of-staff of the Dartmouth Eye Institute, and since 1936 has served as lecturer in ophthalmology in the Harvard Graduate Medical School. He has served as president of the American Ophthalmological Society, American Academy of Ophthalmology and Otolaryngology and the New England Ophthalmological Society; chairman of the Section on Ophthalmology of the American Medical Association; and an officer or member of numerous other scientific groups.

The conditions of the Leslie Dana Medal award set forth that it is to be made for "long meritorious service in the conservation of vision in the prevention and cure of diseases dangerous to eyesight; research and instruction in ophthalmology and allied subjects; social service for the control of eye diseases; and special discoveries in the domain of general science or medicine of exceptional importance in conservation of vision."

Subcommittee to Investigate Keratoconjunctivitis.—The Joint Committee on Industrial Ophthalmology, through its chairman, Dr. A. C. Snell, has appointed a Subcommittee to investigate epidemic keratoconjunctivitis in the Chicago area. New cases are appearing continuously, indicating that a controlled study might be valuable. The members of this Committee are:

Dr. Thomas Allen, Chicago—Member Joint Committee.
Dr. Harry Gradle, Chicago—University of Illinois Medical School.
Dr. Sanford Gifford, Chicago—Northwestern University Medical School.
Dr. Glen Harrison, Waukegan, Ill.—Beasley Clinic.
Dr. H. Woodruff, Joliet, Ill.—Consultant Kankakee Ordnance Plant.
Dr. Hedwig S. Kuhn, Hammond, Ind.—Secretary and Member Joint Committee.
Dr. Edward A. Piszczek, Chicago—Epidemiologist, Cook County Health Unit.
Dr. H. J. Shaughnessy, Chicago—Chief, Division of Laboratories, Illinois State Health Department.
Dr. S. O. Levinson, Chicago—Serologist, Director of the Deutsch Serum Institute of Michael Reese Hospital.

This announcement is being sent to ophthalmologists and medical directors of industry in Cook County, Illinois and Lake County, Indiana, as a renewed warning that epidemic keratoconjunctivitis is still present and that any slackening of constant vigilance might result in an epidemic. The Committee is more than glad, at any time, to assist physicians, industry and public health officials in any way possible, and would appreciate being advised of new cases.

Study of Problems of Children With Severe Visual Handicaps.—This new joint project of the American Foundation for the Blind and the National Society for the Prevention of Blindness has as its objectives: (1) a study of the partially seeing and the partially blind child of school age to determine his unmet needs in the areas of eye care and educational and vocational adjustment, and (2) a survey of the community resources which could be adapted to meet those needs. Dr. Berthold Lowenfeld, of the Foundation, and Miss C. Edith Kerby, of the Society, who have initiated sample studies of this type in the states of Maryland and Florida, report a genuine interest and desire to co-operate, manifested by all agencies concerned.

Knapp Memorial Laboratories Organized.—We are pleased to hear that Dr. LeGrand Hardy has assumed the directorship of a new set of laboratories designed for the study of ocular functions, including physiologic optics, which has been constructed and is now in operation at the Institute of Ophthalmology of the Presbyterian

Hospital, Columbia-Presbyterian Medical Center, New York. The laboratories are being equipped and maintained by the Knapp Memorial Foundation, governed by Dr. Arnold Knapp, Dean Willard C. Rappleye and Dr. Phillips Thygeson. Dr. Gertrude Rand has been appointed research associate for the study of optics and visual physiology. Both Dr. Hardy and Dr. Rand are members of the Advisory Committee of the National Society for the Prevention of Blindness.

How Color-Blind Men are Admitted to Navy and Army Air Forces.—Discussing a technic which it is claimed will educate men who are color blind so that they can pass the armed forces' tests for color blindness, *The Journal of the American Medical Association* for June 5 says: "Obviously, it is for the services themselves to determine whether or not the tests for color blindness now used are sufficient, in view of the possibilities of learning, to screen out enough persons who are color deficient or whether or not the young man who is willing to put in the necessary time in an educational process to learn enough about the tests to enable him to pass them would not qualify because of superior learning ability or intelligence to meet the needs of the armed forces. . . .

"In *The Journal* for March 20 reference was made to an alleged cure for color blindness said to have been devised by one J. H. Lepper, optometrist, of Mason City, Iowa. Subsequent to the publication of that statement, Lepper sent to *The Journal* a communication in which he insisted that he does control color blindness in from fifteen to twenty days so that boys who followed his methods passed government tests. He submitted complete instructions as to the technic that he uses, some special lenses which are used as a part of the procedure, and a list of men now in the Navy and in the Air Force who had previously been rejected but were accepted after having followed his technic.

"The material concerned was referred to appropriate agencies in Washington, which verified the information supplied by Lepper as to the men who had been rejected and later accepted following his attention. Investigators then visited certain optometrists in the eastern part of the United States who follow the Lepper technic and studied their results. These investigators believe that Lepper is conducting an educational rather than a therapeutic process. In his technic the subjects are instructed to get some one with normal color vision to assist them and to trace the shapes of the figures carefully even in those charts in which they can see the figures

fairly well. They are instructed to continue working on harder and harder charts and to keep daily records of the charts which they can read and those which they cannot read. Thus the person concerned builds a learning curve and with sufficient time masters the color manual thoroughly.

"It seems quite likely that those with disturbances of color vision do fix in their minds appearances which are associated with certain colors when viewing objects that have for them some familiarity. No doubt re-examination of these individuals at a later date, using a different technic, would reveal that the persons concerned are still color deficient, although they did learn enough about the test ordinarily used to pass that test and thus enable them to enter military service. . . .

"The optometrists who are now specializing in the Lepper technic might limit their promotion of the method to the statement that they teach men to pass the tests for color vision and avoid carefully the use of the word 'cure' in any relation to color blindness."

Education and Health of the Partially Seeing Child.—Under this title, a volume by Winifred Hathaway, the Society's associate director, is being published by Columbia University Press. The book presents in simple and direct language the ways of providing education and health services for partially seeing children in rural as well as in urban areas, and discusses possible solutions for many of the problems that arise. It will be of value not only to in-service teachers and to those preparing to teach, but to superintendents of schools, supervisors, physicians and nurses in the school health service, and welfare and other social workers. It should be on the "must" list of all colleges and universities for the preparation of teachers. The Columbia University Press plans to have the book available for distribution at $2.50 on or about October 30.

Report Effective Use of New Solution for Epidemic Eye Disease.—Effective use of a solution of sodium sulfathiazole containing desoxyephedrine in the treatment of epidemic keratoconjunctivitis, the new eye disease, is reported in *The Journal of the American Medical Association* for July 10 by H. S. Gradle, M.D., Chicago, and G. H. Harrison, M.D., Waukegan, Ill.

"Epidemic keratoconjunctivitis," the two men say, "has taken an enormous toll of man-hours during the past year, for the average loss of working time incurred in each case is from fourteen to

eighteen days. Consequently any measure that can reduce such wastage is worth trying, even though it may not be uniformly successful. On that basis we are reporting the use of a new therapeutic measure that in our hands has proved worth while. It is realized that the number of cases is small, that the results are only those of clinical observation and that the accurate serologic proof is missing."

The authors say that the new medication is harmless to the tissues of the eye, and reduces the time of the acute aspect of the disease to three to seven days. The solution is used as eye drops. In the 50 cases reported by them treatment was continued for several weeks after the acute phase had subsided.

U. S. Public Health Service Co-operates in Industrial Program.—Readers of the REVIEW will be glad to know that Dr. Joseph Lo Presti, Assistant Surgeon, United States Public Health Service Reserve, has been assigned to assist the National Society for the Prevention of Blindness in carrying on a program in the field of industrial eye hygiene. The Society will act as a clearing house of information for the various governmental and voluntary agencies whose interests include protection of eyesight and conservation of vision in industry.

The addition of Dr. Lo Presti to its staff will enable the Society to develop more thoroughly its activities in the field of industrial eye hygiene which are so vital now because of increased industrial production. It will be able to co-operate even more extensively than in the past with the medical profession, and particularly with industrial physicians and industrial hygiene directors.

A native of Lawrence, Mass., Dr. Lo Presti is a graduate of Harvard University, and he received his medical degree from the New York University College of Medicine. After serving an interneship at Montefiore Hospital in New York City, he did postgraduate work in ophthalmology at Long Island College Hospital.

Limited Service for Men With Physical Defects.—A military opportunity for men with physical defects that in previous wars would have barred them from serving their country in the armed forces has been provided in this war through limited service, Will O'Neil, Chicago, explains in a recent issue of *Hygeia*.

"Last year the Army began taking men with physical defects

that render them unfit for service in the combat branches," he says. "They have released thousands of more able-bodied men for the shooting work of the Army, and their contributions to the success of the Army are by no means limited to kitchen service. Although not classified as combat troops, many of them are going across the seas with their outfits to serve in areas where the action is hottest. Others are remaining behind in jobs at posts and camps throughout the nation.

"Instead of the 13 weeks of rugged basic training given general service men immediately after their induction into uniform, the limited service men are given a month's condensed but intensive introduction to the Army." Mr. O'Neil explains that the operations officer at Camp McCoy, Major William Lutz Krigbaum, is in charge of the Limited Service School, and that in its first month of operation it handled less than 200 men, but now it receives and discharges 1,000 men a week, each of the graduates having been given a carefully planned, twenty-eight-day program of training that fits him for immediate duty.

"About 65 per cent of the men going through the school were rejected for general military service because of poor eyesight," Mr. O'Neil continues. "They have from one-tenth to one-twentieth of normal vision, or they have vision in only one eye. The great number of men wearing glasses is one of the noticeable features of the troops in the camp."

Sixteen per cent of all the men who have physical defects other than those of the eyes have been "reclaimed" for general military service, but only a small number of men with eye defects can be reclassified for general service by the school's doctors. Although the combat branches are closed to the limited service men, they are sent into all of the noncombat branches.

Nutrition Survey Discloses Eye Conditions Among Aircraft Workers.—A high incidence of ocular discomfort in a group of young, presumably healthy men, was found as a result of a nutrition survey among workers in an aircraft industry in Southern California. The survey, reported at length in the April, Milbank Memorial Fund *Quarterly*, was conducted among a large, selected group of men, most of whom were under 30 years of age. Clinica

and laboratory studies for the purpose of disclosing possible vitamin deficiencies revealed thickening, opacity, or localized elevation of the conjunctiva in nearly every subject, evidence of vitamin A deficiency (past or present). Some degree of corneal vascularization was found in every subject, and 35 per cent complained of ocular symptoms commonly found in cases of riboflavin deficiency.

Plans Made to Care for Blinded Members of Armed Forces.—Plans already have been made for the handling of members of the armed forces who are blinded in this war, *The Journal of the American Medical Association* pointed out recently. *The Journal* says:

"Among the casualties of war few merit more immediate consideration than that given to those who become sightless as a result of their participation in the national defense. In World War I, according to available figures, less than 250 Americans were blinded. Thus far the number of British soldiers who have become sightless, including the men from Great Britain and the colonies, is somewhat less than a few hundred. Planning bodies, therefore, estimate that the number of Americans in the armed forces who become totally blind will not exceed a few hundred. For the past six months representatives of the Surgeons General of the Army, the Navy, the Public Health Service, the administrator of the Veterans Administration, the Federal Board of Hospitalization and the ophthalmologic committee of the Division of Medical Sciences of the National Research Council have been engaged in a study of the problem. An elaborate program has been developed to rehabilitate socially and economically those who become sightless. Sufficient funds have been provided by the Congress to meet every possible need. The plans contemplate utilization of existing agencies which deal with the blind. However, public fund-raising campaigns are unnecessary since the over-all need is hardly sufficient to demand special expansion for this purpose in the services of unofficial agencies. In accordance with the executive order of the President, the social rehabilitation of the blind becomes a function of the Veterans Administration and is to be handled by the Division of Educational Rehabilitation and not the medical division. Through the cooperative effort now in process of development the rehabilitation will begin just as soon as the diagnosis is made and will continue from the time of reception of the invalid by the armed forces until the man can be discharged from the Veterans Administration physically, mentally and socially rehabilitated."

Current Articles of Interest

Rôle of the Medical Social Worker in an Ophthalmologic Service, Mabel Lee Price, *Archives of Ophthalmology*, February, 1943, published monthly by the American Medical Association, 535 North Dearborn St., Chicago, Illinois.

In a study of 599 patients in the ophthalmologic clinic of the Hospital of the University of Pennsylvania, almost one-half were found not to have profited fully from the services offered by the clinic. The reasons for failure to complete treatment are not evident from the medical charts. Only two per cent of the group studied actually refused the medical recommendations, but 48 per cent failed to carry out prescribed treatment. The economic status of the patient apparently had little to do with completion or non-completion of treatment.

From previous experience with patients suffering from ocular disease, it is assumed that the most common reasons for the pervading lack of completion of the treatment recommended were: fear of surgical intervention, lack of understanding of the condition, discouragement, and fear of and inability to meet the social and emotional problems arising from the condition. Constructive interpretation of the findings to the patients (or to their parents, in the case of young children) by the medical social worker will prevent the waste of ophthalmologic service and contribute greatly to conservation of vision. Miss Price suggests that the following patients routinely be referred by the physician to the social worker for social study and planning:

A. All patients whose social problems appear to be obstacles to prescribed medical treatment and recovery.
B. All patients with certain diagnoses considered especially hazardous to vision, such as keratitis, iritis, glaucoma, cataract, progressive myopia, strabismus, optic neuritis, retrobulbar neuritis and tuberculous lesions.
C. All patients who refuse suggestions for surgical intervention and hospitalization.
D. All children referred for special educational plans.
E. All patients for whom lenses are prescribed which cannot be procured through regular channels.

A Case of Mustard Gas Keratitis Under Constant Observation for a Period of Twenty Years, T. L. de Courcy, *British Journal of Ophthalmology*, February, 1943, published monthly by The British Journal of Ophthalmology, Ltd., London.

The author had the opportunity of being in close touch with a case of delayed mustard gas keratitis for twenty years. In summing up his observations during this period, the following points seem worthy of note:

1. To judge from the scarring of the corneae when the patient was first seen, actual ulceration must have taken place at the time of gassing (1918).
2. Subjective symptoms appeared four years later with photophobia and report of "bad judgment" in visual efforts.
3. Rapid changes in refraction in the "pre-ulcerative" period of those years (1922–25) in which degenerative changes presumably took place in the corneae to account for these variations in refraction.
4. Anesthesia of the corneae first noted in 1924 but probably present since the initial attack.
5. The necessity for constant observations of this particular case in order to remove aberrant lashes and watch for foreign matter which might injure the anesthetic corneae.
6. The onset of the ulcerative stage seven years after his initial gassing, and its recurrence at intervals during the next twelve years. The moderate vascularization accompanying these attacks.
7. The deposit of cholesterin and other crystals in the corneae in the earlier stages of the disease and their gradual disappearance.
8. Drugs used as drops had to be prepared in much weaker solutions than for ordinary keratitis. Pure carbolic must never be used.
9. The disappointing results of tarsorrhaphy, since soon after reopening the lids, ulcerations again took place.
10. The possible good results of *x*-rays carefully applied.
11. The undoubted benefit of short-wave diathermy.
12. The protection provided to the corneae by fitted contact lenses and the striking increase of visual acuity resulting from their use.
13. The late appearance of "islets" of blood over the pupil areas and their disappearance after peritomy.
14. The fact that no focus of infection was found in the patient to predispose him to mustard gas keratitis—the usual tests having been made at the time of his first attack of ulceration.
15. Lastly, that after twenty adventurous years the patient leads a practically normal social and business life.

The Measure of Night Vision, N. Bishop Harman, *British Medical Journal*, January 9, 1943, published weekly by the British Medical Association, Tavistock Square, London, W. C. A standard expression of quality of night vision is proposed by the author, to be used in conjunction with the disk-spotting test. This test is based on a direct measurement of light, so that results may be exactly comparable and a definite measure may be made of the minimum light necessary for an individual to see an object or objects. The light is reflected from illuminated disks on a black velvet background and the distance found at which the disks can be seen and counted. The illumination is from the "standard candle," and there can therefore be such an exactness of the light used and of its measurement that the returns of the examination are definite. There has been found to be a common average for all classes and ages: a distance of 5 meters, at which point the light is 1/1075 of a foot-candle.

If the figure 5 is used as the denominator of a fraction of which the numerator is the reaction of the particular individual tested, the resultant figure will express the facts of the finding in a way readily understandable to anyone. If the figure registered is 5/5, everyone will know that night vision is normal. If the figure is 2/5, it is clear that night vision is poor; if it is 8/5, no one will doubt that it is exceptionally good. These figures carry an exact appreciation of the night vision of the person examined, just as the notations of the Snellen test carry for visual acuity.

Pathological Findings in Eyes Enucleated for Glaucoma Due to Sarcoma of the Uvea, Louis Bothman, M.D., *Illinois Medical Journal*, March, 1943, published monthly by the Illinois State Medical Society, 30 N. Michigan Avenue, Chicago. Of 40 cases of sarcoma of the uvea, there were four in which sarcoma was not suspected when the eyes were removed. The clinical diagnosis in all cases had been secondary glaucoma. The author points out that these cases should serve as a warning, in all cases of secondary glaucoma of unknown etiology, against a detension operation. The operation of choice for blind, painful eyes, when no study can be made of their interior, is enucleation.

Book Reviews

INDUSTRIAL PSYCHOLOGY. Joseph Tiffin, Ph.D. New York: Prentice-Hall, Inc., 386 pages.

This book covers the entire field of industrial psychology, while devoting appropriate attention to employee selection and placement. Fitting the worker to the job is of importance today from the standpoint both of the war effort and of assuring the individual worker happiness and satisfaction on the job. And no writer is better qualified to speak on placement in industry and the broader field of industrial psychology than Dr. Tiffin.

If anyone doubts the high scientific plane to which industrial psychology has ascended, he should read Dr. Tiffin's chapters discussing visual problems in industry, industrial attitudes and morale, industrial inspection, accidents and safety, dexterity and manipulative tests, employee testing and industrial merit rating. The author has consistently maintained that placement tests are good tests only if they succeed in selecting employees for certain jobs who are more adapted to those jobs than would have been the case if the employees had been otherwise selected. In other words, the tests themselves must be tested and the criterion is the result obtained.

More space is given to visual problems of industry than to any other subject. After describing many experiments in which analyses of visual performance were made in relation to ability on the job of thousands of workers, it is concluded that no single visual test is a satisfactory placement test, but rather the test or tests must be selected for the specific job on which the worker will be placed. A battery of tests, including visual acuity for near and far, depth perception, color vision and phorias (postural characteristics of the eyes at appropriate distances), offers a very satisfactory all-round rating of visual performance.

Instances have been found, the author points out, in which arbitrary minimum standards of vision have not only failed to select the better potential employees, but actually selected the poorer ones, as, for example, where near vision is needed and the

eyes have been tested at the usual distance of 20 feet. Employees and applicants differ just as markedly in visual characteristics when they are adequately measured as in any other characteristics, and these differences correlate in many respects with differences in job performance.

Another study indicates a relationship between poor vision and accident experience. In a group of several thousand steel mill employees unclassified as to job, those who failed certain tests had more accidents on the average than those who passed. The author indicates, however, the need for separate determinations for each job in order to take into account specific job hazards and job visual requirements.

Of unusual interest are the experiments with special occupational spectacles conducted under the medical supervision of Dr. Hedwig S. Kuhn. The prescriptions for the spectacles include a component, over and above what would be indicated for ordinary lens correction, that has the same optical effect as though the work were removed farther from the eyes, but without loss of visibility. In psychological terms these lenses modify the visual requirements of the job so that they come within the range of adaptability of a larger number of potential operators. These spectacles are worn only on the job; they are part of the job equipment or tools. At other times each operator wears only those spectacles, if any, which are desirable for general use. Operators using the occupational spectacles showed a five per cent increase in production over control operators.

Also discussed are job simplification, visual classification, visual maintenance of personnel, periodic retests of vision, the visual survey, maintenance of occupational eye wear, the objectives of a visual program, and employee education in vision.

This book will do much to extend the application of psychology to industrial uses—a challenging and rapidly expanding field, which has timely implications for the war effort.

—Clifford Kuh, M.D.

FIRST AIDS IN READING DIFFICULTIES. S. Weir Newmayer. Philadelphia: North American Printing Co., 1940. 162 p.

The author's contact with reading disability cases has convinced him that these cases are not understood because little consideration has been given to certain medical factors. As a specialist in ophthalmology and child hygiene, he interprets reading largely in terms of eye-muscle co-ordination. One gains the impression that the author considers nothing but vision as really significant in reading, for in his opinion, reading is one hundred per cent vision. He is obviously out of sympathy with methods of diagnosing ability to read which tend to ignore the rôle of vision in reading. He makes the point that visual acuity may register normal and the child may still be a poor reader because of visual defect. However, he gives no comparison statistics, reports no controlled experiments to show the extent to which vision can and does affect reading.

The contents of the book belie its name for there is relatively little information about reading disabilities or remedial methods. There are chapters on binocular vision; influence of planes of vision; accommodation; tests of visual acuity; diseases and defects of the visual organs; visual confusion; hygienic conditions for reading; and eye training. Many important facts about the visual organs are given, the physiological factors in seeing; and there are some excellent diagrams to illustrate the facts, but this information is not linked up to the reading process.

There is a great deal of information about the physiology of the eyes that does not give much background for understanding the rôle of the visual organs in reading. There is considerable discussion of surveys of vision in school children without any reference to reading problems. However, the factual information and practical advice given with regard to vision impress the reader as helpful. Recommendations of the Illuminating Engineering Society on lighting school buildings are included.

A chief limitation of the contents is the author's failure to back up his opinions with scientific evidence. In addition, his understanding of the reading process psychologically is limited and his ideas may on that account be misleading to teachers. The diction is poor, paragraphs are poorly organized. The disjointed statements are difficult to follow.

In many paragraphs the author fails to make any clear-cut point.

He tends to skip about from topic to topic with little connection from one to the other and the lack of paragraph and section headings makes the content difficult to follow. Some topics, for example, such as "Special Classes for Mentally Retarded" appear to be quite irrelevant. —GERTRUDE HILDRETH, PH.D.

OPHTHALMOLOGY AND OTOLARYNGOLOGY. Prepared and edited by the subcommittee on Ophthalmology and Otolaryngology of the Committee on Surgery of the Division of Medical Science of the National Research Council. Philadelphia: W. B. Saunders, 1942. 303 p.

This is one of a recent series of manuals on war medicine and surgery. The first section of this volume deals with ophthalmology. Its aim, as stated in the preface, is to enable the medical officer stationed in the field or in an evacuation hospital to cope with the most common eye injuries and diseases, at least until he can transfer the patient to a base or general hospital where an ophthalmologist is available.

The manual covers in a simplified and abbreviated form the fundamental phases of the subject, namely: functional tests, including some simple tests for the detection of malingering; methods of examination of the eye; sudden blindness or impairment of vision from various causes, including psychoneurotic visual disturbances; acute inflammations; injuries of the eye and of adjacent regions; and surgical procedures.

The book is a compilation by several authors and suffers some of the faults which so often are a concomitant of this form of writing. Its chapters lack continuity, there is overlapping of subjects while many topics are either entirely omitted or receive only brief mention, and the quality of the various chapters is not uniform or consistent. However, it should prove very useful to those for whom it is intended, since it bears directly on the problems encountered among troops.

The chapter on surgery and methods of anaesthesia, written by Dr. William L. Benedict is to be especially commended for its conciseness, coupled with a clarity of exposition which is greatly aided by the numerous illustrations.

Even though a book of this size can hardly be intended as a reference work, its usefulness in this direction is greatly enhanced by the detailed index and by the numerous cross-references in the text. —ADOLPH POSNER, M.D.

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Medical Aspects of Refractive Problems*

John N. Evans, M.D.

THE author shows the rôle of the ophthalmologist as diagnostician.

The "Eye Man" at the Turn of the Century

When we look back upon the science of ophthalmology in relation to internal medicine, we find that the picture has changed so radically in the past quarter century as to require redelineation. A discussion of certain aspects of its general diagnostic usefulness seems timely.

A review of ophthalmic literature at the turn of the century discloses a school of "eye men," who, with Gould as leader (the same Gould who provided a medical dictionary), contended that the correction of errors of refraction resulted in the cure of innumerable ailments far beyond the claims of modern ophthalmology. There was a growing tendency, however, to include the more conspicuous eyeground studies in their offerings, but rarely do we find entities described other than the so-called classical, albuminuric retinitis, primary optic atrophy, or papillitis.

The "eye man" of that day was looked upon as a rather helpless creature. He had apparently deserted his medical training and had become entirely dependent on his professional brethren to run down the etiological background of iritis, ocular palsies, etc. In fact, this relation was so strongly impressed, that he was subject to criticism as overstepping his field if he discussed medical aspects of a case in any detail. As a consultant, he was supposed to limit his efforts to the visual organ, usually only the eyegrounds, and from this single source make a precise diagnosis of, for example, a particular form

* Presented at the Twenty-fifth Anniversary of the founding of the Mexican Society for Prevention of Blindness, Mexico City, August 13-21, 1943.

of kidney disease. This appears most unreasonable when we realize that the ironbound classifications of kidney disease, as then in force, had to be abandoned as worthless. The generalities of Volhard and Farr were substituted. It was not at all uncommon to have him looked down upon because he had not been able to decide whether a slightly blurred optic nervehead was due to pressure or an early inflammatory process, a differentiation which often cannot be made in the microscopic section. In fact, he was limited to a "snap diagnosis."

This intolerable position of ophthalmology was perhaps due to the state of flux in which all medicine found itself, because of the enormous expansion it was undergoing. There was an acute pressure for subdivision of work in order to develop the necessary degree of skill called for by the application of the methods of refined physiology and pathology, which were then being applied to clinical medicine.

The Ophthalmologist of Today

There is no longer any excuse for the existence of that outmoded and anomalous creature, the "eye man." He was once the parasitic helpless embryo. The ophthalmologist of today completes his own medical review of a case and calls in a fellow consultant only for the unusual problem. During the last twenty-five years the ophthalmologist has developed as a general diagnostician so that it is not uncommon for him to have outstripped the so-called "family doctor" in his own field.

This has been called an age of specialization, and it is said that the effect is very narrowing. This statement is made of ophthalmology by those who have not noted the expansion of the specialty in the last quarter century. No specialty has a right to exist unless it keeps its field intimately related to medicine as a whole. In order to appreciate the full meaning of this close interrelation, let us consider a concrete instance as met in whole, or in part, in the daily routine of private practice.

Referral of Patient

A general practitioner refers a patient to an ophthalmologist. The patient in middle life brings a statement from the referring physi-

cian to the effect that the patient's general physical health is good. Upon inquiry the ophthalmologist finds that the physical review consisted of a very meager history, supplemented by voluntary statements from the patient; percussion and auscultation of heart and lungs; a blood pressure record, and a drug-store urinalysis. The patient's ocular complaints are simply that he has been suffering from blurred vision and, on occasion, sees black specks floating before his eyes. He is also annoyed by the presence of yellowish chamois-like patches on his lower eyelids. He has noted that his glasses, which were originally prescribed for farsightedness, no longer give him distinct distance vision; but he is elated by the fact that his near vision has apparently improved so that he no longer needs separate glasses for reading.

These complaints immediately suggest the need of a detailed medical history and imply the necessity of special questioning along certain lines. The basic points in the history show that the patient had a mild attack of influenza eight weeks previously. He did not recover from this rapidly as the infection was complicated by a moderately acute attack of follicular tonsillitis and acute bronchitis. The patient thinks he has been passing unusual amounts of urine, having to arise twice at night.

Ophthalmological Examination

As a primary and fundamental step in the examination, the ophthalmologist undertakes a study of the eyeglass problem. As the result of the "refraction," he finds that the patient has become nearsighted, as compared with an examination made one year previously.

The systemic implications of these findings are very portentous when we consider the possible mechanisms bringing about such an alteration. The transparent media of the eye have a certain refractive power which is in effect altered by the biological processes in general and usually undergoes a certain pattern of changes during the life of a healthy individual. For instance, farsighted people tend to become slightly more farsighted up to puberty. The refractive error then decreases gradually until maturity (20–30 years), then remains relatively stationary. A patient may become slightly less farsighted after the age of sixty. During his adult life a moder-

ate amount of astigmatism may disappear around the fortieth or fiftieth year, to reappear at an opposite axis.

The eyes ordinarily are not *nearsighted* at birth. Some eyes may gradually become so; and myopia is discovered when the child starts school. It usually increases until the individual has passed his periods of rapid development, and then remains fairly stationary for the rest of his days. Beginning at about forty years of age another change, called presbyopia, or "old eye," appears, wherein the refracting tissues lose their natural elasticity and no longer can be (sufficiently) modified for near vision by the muscles of accommodation. Additional reading lenses then become necessary in increasing strength, in proportion to the patient's age. We say he has become presbyopic.

When these usual evolutionary patterns of refractive errors are radically departed from, the ophthalmologist must not be content until he has explained the etiological mechanism. Measurements, taken from the subject's eye to the point at which he reads fine print most distinctly, may also give very valuable information. If one eye focuses best at a greater distance than the other, we have added data of significance well nigh equal in value to that obtained by refraction. This simple procedure should be used by every internist as a possible aid to any physical survey. Interpretation of such findings must, however, be left to the ophthalmologist in order that purely ocular conditions may be ruled out.

Glaucoma

The case cited above demands special study to that end. Perhaps one of the first things to suggest itself when this change has come about in middle life, is glaucoma. The ocular tissues have taken on a much greater watery content so that the pressure within the eyeball is increased and the *index of refraction* is slightly modified. The *crystalline lens is moved forward*,* thereby throwing its focus forward off the retina, or the eyeball itself might have become enlarged by stretching, thus moving the *retina backwards*. The *ciliary* muscle is often much weakened so that it can no longer adequately

* This can hardly be a major factor, however, as a forward movement of the lens of 1 mm. will result in only .6D change in the refraction. The entire distance from lens to back of cornea is only 3 mm. so that the maximum possible change could not produce variations large enough to correspond with those often found.

modify the lens curvature. The most characteristic change of glaucoma is the rise of pressure within the eye. It is not sufficient just to measure this pressure with the tonometer. It is necessary for us to seek other evidence of glaucoma. This means study with the corneal microscope and slit-lamp, studies of the visual fields, measurement of the size of the pupil, and even our so-called provocative tests, to determine whether the condition is in its doubtful borderline stages.

The object of the provocative tests is to unmask early evidence of glaucoma and to disclose sensitivities and idiosyncrasies of the particular case. To this end it is often necessary to study the patient in the hospital for twelve hours continuously. His visual fields and ocular pressure, his pupillary changes, vision and blood pressure, etc., are studied while the subject is reclining and again when he is standing. They are repeated after he has imbibed water, after caffeine has been administered, after the pupil has been dilated, after the subject has been kept in a dark room, and after ocular and systemic medication.

Beginning Cataract

Let us assume, then, that glaucoma has not caused this change in the refractive condition of the patient's eyes. We must next consider the possibility of a beginning cataract.* Such a change need not necessarily come on in an old person but it is very rare to find in people under fifty.† They may refer to this change as "second sight" when they discover reading glasses are no longer necessary.‡ Cataracts are diagnosed from the history, by ophthalmoscopic study, then with the slit-lamp, corneal-microscope and so forth. During such an examination, it is necessary to be sure that a secondary cataract is not developing; that is, one having its origin primarily in a systemic disease. The examiner must keep in mind

* Other purely ocular lesions can cause changes in refraction (ptgerygium, post-operative changes after cataract extraction, transplantation of muscles, traction by scar tissue, pressure of eyelid growths, etc.) by mechanical distortion. A change in the radius of curvature of the cornea of only .18 mm. produces one diopter of astigmatism and is enough to give rise to marked symptoms (3).

† According to Parsons (6) who quotes Frey, the youngest case of diabetic cataract on record is a child of five years.

‡ This need not necessarily imply that the subject is going to lose his vision through cataract development as the process may be of very slow progress. In fact, some authors (4) think such a change means vision is about to attain a certain useful stationary level.

focal infections as of the teeth, tonsils or intestines, which give rise to iritis and choroiditis. Rarer conditions, such as tetany, Marfan's disease, *dystrophia myotonica*, the benzene poisonings, (2) etc., must not be overlooked.

In recognizing such conditions, there are, of course, certain points of a suggestive nature which have been brought out in taking the history. The patient may admit that he does not see quite so clearly as he formerly did. Blurred vision due to cataract has its own characteristics. For instance, the patient with optic atrophy complains that his vision is blurred by a fog-like haze which seems to fill space before him. Intraocular hemorrhages give rise to a curtain-like effect, which may later appear amber in color. A patient who has retinal disease may complain that objects look distorted, whereas if he has opacities of the vitreous he may complain that objects seem to be obscured by the darkening effect of a black dust. And so, in cataract, patients will complain that familiar objects have fringes on them; that letters look raised on the page, that lights have streaks and rings about them, and that vision varies greatly.

Diabetes

Let us conclude, in this particular instance, that we have not been able to discover evidence of glaucoma or of cataract. The next most likely possibility is diabetes melitis. We have already suspected the possibility of this disease from significant facts in the history, and we found that it is not sufficient to eliminate this possibility on the basis of a urinalysis. We must insist on a blood sugar determination. There has been much discussion as to the cause of this radical change in the refractive error in diabetes (5). In some instances, the change comes on only with the advent of the disease. In other instances, it occurs later, and it may be transient or permanent. The refractive change may come and go once or it may occur repeatedly, and it does not necessarily affect both eyes at the same time or equally. It may or may not be associated with the administration of insulin.

The index of refraction could not be raised sufficiently by the amount of sugar capable of entering the eye to explain the phe-

nomenon. At the present time, it is assumed on fairly secure evidence, that this effect is brought about by change of form or position of the crystalline lens due to modification of its water balance* or to unknown metabolic toxins. A modified ciliary muscle can bring about apparent anomalies of the refractive error, but this can probably be minimized in this instance for many technical reasons. There actually seems to be no theory which fits all the facts for the explanation of atypical changes in refraction. Changes of lens curvature as a whole, as of the various laminated layers, is less accepted by many as the basis of the changes. Perhaps this is only because so many data are missing on intrusive lens changes during accommodation, and from year to year. The absence of the classical diabetic retinitis or the so-called pathognomic eye sign, *lipemia retinalis*, gives helpful but not positive evidence of the absence of hyperglycemia.

Other Conditions

We shall now suppose that we have not explained the change of refraction, in this particular subject, on the basis of diabetes. One must then consider other factors. In the experience of the writer, such a change has been discovered in adult life in patients who have suffered radical loss of weight (20–30 pounds) in a short period of time and most particularly to patients the subject of neoplastic disease in other organs and may or may not be associated with X-ray or radium treatment of such cases. Rarely such a change is seen in hyperthyroidism, but the advanced state of the disease soon diverts attention to the various other ocular changes. We need not consider them here.

Liquefaction of the vitreous humor during the course of inflammatory disturbances in that tissue is common. Changes in refraction have been reported in such cases. This is very hard to interpret because in an eye which has suffered such damage, many of its other structures are involved which might be the basis of the disturbed refraction. In this particular case, it is not unlikely that the myopia which developed quite suddenly during the last few weeks of the respiratory infection was the indirect result of the adminis-

* It is obvious that this may also be related to the acid-base balance.

tration of a sulfonamid* (7) given when a tentative diagnosis of lobar pneumonia had been made. Myopia produced by this agent is usually temporary, so that gradual recovery to the original refractive state is anticipated. The mechanism of its action is thought to be similar to that caused by diabetes. It is at once evident from the above that the whole series of possibilities outlined† becomes apparent by a study of the history and that recognition of the significance of the refractive changes was paramount. Had this patient been unfortunate enough to consult only the average optometrist or a careless ophthalmologist, the prescription for eyeglasses, without further consideration, could easily have resulted in death or permanent blindness.‡ No one would have suspected that a clue to any one of these quite correctible conditions had been passed over through ignorance of very simple and basic medical facts. Intelligent questioning of the patient when obtaining the history demands a well founded medical background and experience with these various disease possibilities.

Meaning of "Spots Before the Eyes"

Our detailed consideration of the refractive problem disclosed certain collateral evidence which, though not directly contributory to the diagnosis, must be analyzed and interpreted if our study is to be completed. We recognize, moreover, that any changes in the transparent tissues of the eye may modify the refraction. Thus we have not explained satisfactorily the symptoms of which this patient complained in describing the "buglike objects" which annoyed him. "Spots before the eyes" may be anything from a

* E. Ellett (3) discusses a great variety of factors which are capable of modifying the refractive state of the eye and the mechanism which may explain them. He mentions quinine poisoning and cites cases but points out that even a saturate solution of quinine would not elevate the index of refraction, as it has nearly the same index as normal aqueous humor. The complications which confront us are well illustrated by a case reported by Tron to which Duke-Elder refers (Practice of Refraction, 4th Ed., 1943, p. 79, Blakiston). Though the eye was practically of normal size, 22.39 mm., the refractive error was actually −20.00. If the myopia had been due to over-size of the eyeball, it would have measured about 30 mm. in diameter. It is obvious that the myopia in this case was entirely due to a change of the index of refraction.

† No attempt has been made to cover other rarely encountered conditions which could produce such changes. Alvaro (7) mentions a number of rare conditions which are said to have caused marked changes of refraction.

‡ This is no far-fetched supposition. We see the results of such ignorance in everyday practice.

shadow of one's own blood corpuscles to manifestations of serious ocular damage. We have all seen the movement of the normal blood corpuscles (rapidly moving bright motes) as we recline in the dentist chair gazing at the uniformly gray sky. We see them more dramatically when viewing the X-ray plates against the fluorescent light. Possibly to be classed as physiological debris are also numerous discarded and unabsorbed embryonal remnants from the vascular system of the lens and pupillary membrane. These persist as minute fragments and go unnoticed for years until the "black floaters" come to the patient's attention and give him great concern. We have much to learn about these physiological disturbances but we do know considerably more about the pathological formations. The simple wear and tear of our body tissues result in gradual breakdown, and remnants of such degenerated tissues gradually accumulate in the humors of our eyes. Since the vitreous is normally transparent, shadows of this debris may fall upon the retina, becoming evident to the subject as tremendous enlargements of the actual particles. The ophthalmologist can see these directly with the ophthalmoscope or slit-lamp. They appear to him, for the most part, as minute gray dots hardly visible even when magnified ten or twenty times. As we cannot restore youth to the aged, so we cannot remove or relieve these symbols of aging, and we are justified in neglecting them only when we have satisfied ourselves that they are not of more significant origin.

What are these significant origins? First, we have remnants of minute hemorrhages. Any hemorrhage in the eye is always of great significance no matter how small, and we should try to discover the source and the cause. We consider the causes of bleeding from larger vessels, such as arteriosclerosis and hypertension and kidney lesions, and we consider the causes of bleeding from capillaries as the blood dyscrasias, etc. Such pathological changes are explainable by thorough investigation, and our corneal microscope is particularly helpful. Besides our eyeground examination, we are often able to see individual red blood corpuscles, strands of fibrin, or actual blood clots, and even if we cannot see the site of bleeding, our visual field tests may give us very suggestive evidence of the general nature and location at which the process originated.

Vitreous opacities may also and commonly do arise from inflam-

matory processes which may or may not be visible with the ophthalmoscope. Such lesions give rise to exudate and often call forth active cellular response of the reticulo-endothelial system. These products may be evident as they diffuse through the transparent media, and their site may be located quite accurately by study of the visual field. Such findings may indicate the presence of a solitary lesion or of a diffuse process—the result of a focal infection. It hardly seems necessary to point out the importance of associating such changes with a period of a sudden loss of weight or general debility. In the present instance, even if a specific eye lesion were not discovered, it would be worth while suggesting X-ray pictures of the patient's chest and other measures in order to rule out the possibility of systemic tuberculosis, particularly if the patient is in that "young adult period" so susceptible to the pulmonary form of this disease. Vitreous opacities arising from blood clots or inflammatory changes usually give rise to such dense opacities that they cast black shadows on the subject's retina which are so sharply defined that he can draw a picture showing the shape and relations of the larger ones. As already pointed out, radical changes of the index of refraction often accompany or follow disturbances of the vitreous humor.

In the case of the patient under consideration, we may find minute scintillating specks floating about in the vitreous and our attention is recalled to one other sign which this patient presented and which must be carefully considered. It is often overlooked or passed by with a casual suggestion for surgical removal for the sake of cosmetic effect. I refer to the chamois-like yellow patch of which the patient complained, appearing on the lower eyelids. This symmetrically placed superficial lesion is diagnosed as xanthelasma.

The presence of the xanthelasma cannot be considered without serious thought of its possible relation to the whole picture of the xanthomatous diseases (8). For instance, the presence of general skin lesions typical of the "*tuberosa*" *form* of disease is often associated with cardiovascular, liver, and pancreatic damage, while the *desseminate form* may be associated with damage to the bones, lungs, and brain and also with diabetes insipidus. Either of these forms of xanthomatosis may be associated with the insignificant looking yellow patch on the eyelid so that we are obligated to

search for other evidence of disturbed cholesterin metabolism in the ocular tissues. Cholesterin crystals may be found in the vitreous humor and in other ocular tissues and may appear in arcus senilis and degenerative lesions of the choroid and the retina. All these findings may be associated with distortion of the normal refractive curve. The ophthalmologist is thus obligated to refer to such findings in his report to the referring physician, and to suggest blood cholesterol studies as a preliminary.

It is thus evident that from a very minor "eyeglass" complaint on the part of the patient, we are able to unfold ophthalmological evidence of systemic diseases which is of utmost significance. I might have selected numerous other apparently trivial complaints, for instance, "*tired eyes*," a symptom which leads us through the hypochromic anemias to serious cerebral lesions; I might have considered the "*aching eyes*" of ciliary muscle cramp and shown a relation to colitis and vasomotor disturbances;* I might have considered "*double-vision*" and shown how it leads us into an elaborate study of neurological disorders, from cerebral vascular accidents of old people through brain tumors to multiple sclerosis of the young adult. Thus we find that nearly every patient past middle life offers tempting signs during refraction which extend the field of inquiry into every branch of general medicine.

Ophthalmology—A Broadening Field

So it becomes evident that ophthalmology is broadening, not narrowing, for those who apply it properly. It has eliminated the "eye man" of the past. It offers an ever expanding view of the future. The best proof of this lies in the fact that ophthalmology is progressive. It cannot be threatened with extinction as have other specialties by the recently discovered therapeutic group,† or by a reclassification‡ of disease. It cannot be replaced and those who neglect its full facilities relegate themselves forever to the past.

* A. Prangen (9) reports an instructive series of cases of spasm of the accommodation. He found a neurological or focal infection background in most of them.

† I refer to the extinguishing tendency of the sulfonamid drugs on the otolaryngologist and the genito-urinary specialist.

‡ This could refer to a number of branches of medicine but might be applied especially to the shift of syphilis from the neurologist, to the urologist, and then to the dermatologist.

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How Can Ophthalmologists be of Greater Service to Industry in Wartime?*

C. D. Selby, M.D.

CITING the "Outline of Procedure for Industrial Physicians in Industry" prepared by the American Medical Association Council on Industrial Health, the author shows how such procedures apply to eye care and safety.

THE ophthalmologist serves industry as a consultant in the handling of occupational injuries of the eyes and as an expert in the settling of claims for compensation involved in eye injuries. Industrial medicine began in a small way with the care of occupational injuries. Over the years this has expanded into a complete health program in which the care of injuries, though still important, is relatively a minor function.

From the title you have assigned to me for discussion it is assumed that you wish some suggestions as to how the ophthalmologist can participate in the broadened industrial medical program and thereby extend your opportunities for service to the industries which are giving to the war effort. Let us work this out together.

What is the industrial medical program? It consists of those medical functions which have to do with the prevention of sickness and the care of occupational diseases and injuries. The objective is to control disabilities of occupational origin and give the employees the best possible health protection consistent with the purpose of industry, the employer's legal responsibilities, and the employee's rights in the free choice of physician for care of sickness and injuries not legally related to occupation.

* Presented before the American Academy of Ophthalmology and Otolaryngology Chicago, Illinois, October 10, 1943, and published in the Academy *Transactions*.

These functions are specified in the "Outline of Procedure for Industrial Physicians in Industry" which was prepared by the Council on Industrial Health of the American Medical Association and published in the March 14, 1942 issue of the *Journal*. I shall quote from this, and after each section let us consider the possibilities for ophthalmological assistance and guidance to the industrial physician.

Prevention

"The physician should acquaint himself by regular inspections with all materials and processes used in the working environment over which he has supervision, to the end that he may recommend appropriate protection of employees from conditions actually or potentially harmful."

Suggestion.—This suggests the possibility of studies of the illumination of manufacturing areas, the kind of lighting that is best suited to the different occupations, the placement of fixtures and the projection of the light for best results with a minimum of fatigue to the eyes of the workers.

Industrial Physical Examinations

"Preplacement physical examinations should be complete. They should be used only for the purpose of assigning work adjusted to the physical and temperamental fitness of applicants and to maintain safe and healthful employment for all employees.

"Subsequent physical examinations should be complete enough to provide positive health protection for all workers and to safeguard the public welfare. Repetition of such physical examinations must be determined by the physician in accordance with specific requirements.

"In the interest of completeness and uniformity, physical examination forms are recommended. Personal records of this character are confidential and should always be kept in the custody of the medical department. Access to these records should be granted only on request or consent of the examinee.

"The examining physician should acquaint the examinee with the results of all examinations or take steps to refer all conditions requiring correction to the physician of the worker's choice."

Suggestion.—This suggests participation in the examination procedures. As you know, so far as eyes are concerned, industrial

physicians are general practitioners. Their examinations of eyes are necessarily superficial. They may use the ordinary Snellen chart or one of the devices for testing eyes. To some degree they check near vision and possibly the glasses that are worn, though, admittedly again, superficially. Unless a workman is unsighted the quality of his production depends substantially upon his eyesight—usually his near vision. Why not propose a method of participation in the examination of the eyes and the glasses of the workers with the view to obtaining correction where needed and proper job placement?

Health Education

"The plant physician should take advantage of all opportunities for beneficial instruction of the workmen in hygienic living both in and out of the industrial environment."

Suggestion.—This suggests opportunities for advice to employees on the care of their eyes, possibly talks on the use and health of the eyes, etc.

Medical and Surgical Care

"1. Treatment of Compensable Injuries and Diseases: The disabled worker should be free to choose his physician from all those licensed doctors of medicine competent to supply the required services except in situations provided for by chapter III, article VI, section 3 of the Principles of Medical Ethics. This provides that the intervention of a third party who is legally responsible either for the cost of care or for indemnity or who voluntarily assumes partial or full financial responsibility for medical care does not per se cause a contract to be unethical.

"2. Treatment of Noncompensable Injuries and Diseases: The treatment of injuries or diseases not industrially induced is the function of private medical practice. The physician in his industrial relationships should abstain from such services except in the case of:

A. Minor ailments. The physician in industry may treat minor physical disorders which temporarily interfere with an employee's comfort or ability to complete a shift, and for the relief of which he may need immediate medical attention.
B. First aid for urgent sickness. The physician in industry should employ such measures as the emergency dictates

in all cases of urgent sickness occurring during working hours on the working premises, until such time as prompt notification of the family physician relieves him of further responsibility.

C. Rehabilitation after sickness and injury. The physician in industry can properly assume responsibility for those phases of rehabilitation after disability industrially induced or otherwise, which progress best under controlled working conditions."

Suggestion.—It is evident that the medical and surgical care of eyes is limited in industry and no services in this respect are necessary beyond those which the ophthalmologist now renders. Nevertheless, it might be possible to make arrangements for on-the-job service which would entail at least a part-time attendance at the plants. This is practiced in some large industries with good effect.

Research

In the group of plants that I know best, certain obscure eye problems which do not appear to be covered in the procedures advocated by the Council on Industrial Health arise from time to time. For instance, some occupations, such as welding, may be thought to be harmful to the eyes. This question was put to our doctor. An ophthalmologist was asked to make an eye study of eyes of the group. He did so and his report was convincing to the workers and comforting to the management. These and similar problems do arise.

Suggestion.—This suggests the need of industrial ophthalmological research. You may see possibilities in this of which industrial physicians are not aware.

Goggles

Here is a very practical matter. Goggles are used for eye protection. Workers will not wear them if they are ill-fitted and uncomfortable, if the lenses steam up, if they cannot see through them clearly, and for many other reasons. So the expert fitting of goggles, their maintenance, sterilization and repair, and the use of prescription lenses where needed are at all times important.

Industry has had difficulty in securing the help of ophthalmologists in these matters.

Suggestion.—This suggests the need of a goggle program.

Conclusion

The suggestions thus far made have arisen out of practical experience. It may be possible for a group of ophthalmologists, whose contacts with industry are obviously casual, to comment upon them, improve them and offer others. But I am inclined to believe that the ultimate solution of large industries' eye problems is in this final suggestion, that part-time industrial ophthalmological service be advocated by your group and that measures be taken to acquaint the medical directors of large war industries with the potentialities of such a service.

Nursing Care of Eyes in Industry*

Eleanor W. Mumford, R.N.

DISCUSSES first aid equipment and procedures, foreign bodies in the eye, physician's standing orders, first aid and compensation, vision testing, and goggles.

In industry a nurse meets eye problems such as she scarcely ever confronts in any other field of nursing. The three major responsibilities likely to be delegated to her are: first aid in eye injuries, testing vision, and part or all of the goggles program.

First Aid

The most frequent type of eye injury is a foreign body in the eye. Because this is such a commonplace experience, it is often treated very casually; but unless properly handled, it can result in serious damage to sight or even in loss of an eye. Every effort should be made to teach workers and foremen that no attempt should be made to remove a foreign body at the scene of the accident. Rather, the worker should be told to go promptly to the first aid room where the necessary care will be given by the doctor or nurse if present and, if not, by a carefully trained first aider.

Only in chemical burns should first aid for an eye injury be given at the scene of an accident. In this case, the eyes should be washed out immediately, preferably by immersing the face in clear water and having the patient open his eyes under water. He should then be brought to the first aid room where the process of washing out the chemical with water can be continued, and as soon as this is adequately done the patient should be referred to

* Presented at the Meeting of the New York Industrial Nurses Club, November 19, 1943, and published simultaneously in the *American Journal of Nursing*.

an ophthalmologist. No oil or ointment should be put into the eye without a direct order from the doctor, as this interferes with the ophthalmologist's examination.

First Aid Equipment and Procedures

Let us now consider the equipment and procedures for the care of eye injuries in the first aid room. As patients receiving eye care are likely to be nervous and often wince or move at the wrong moment, many ophthalmologists prefer that all eye treatments, even the removal of a simple foreign body, be given with the patient lying on his back on a treatment table. This has a dual advantage, in that it helps the patient to relax and it provides a steady rest for his head. If a table is not available, a chair with a head rest is needed. Two other essentials are a good, direct light on an adjustable standard, and a magnifying glass. To free both hands for eye care the magnifying glass should be either the type which comes on an adjustable stand or that which is worn like spectacles. The latter is known as a binocular loupe and can be used over the wearer's own glasses.

Recent outbreaks of epidemic keratoconjunctivitis have impressed upon us the importance of aseptic technique every time an eye is handled. All equipment for eye care should be used for that purpose only and should, of course, be sterile. If eye injuries are infrequent and minor, an eye tray will suffice; but if there are many accidents, it is desirable to set up either a separate room or at least a corner of the general treatment room, and an eye table will be needed instead of the tray.

All equipment on the eye tray or table should be kept in sterile covered containers, and a schedule for resterilization followed. If not in frequent use, solutions can be resterilized weekly, but if in constant use, this should be done not less than twice weekly. As medicine droppers are easily contaminated, a separate sterile dropper should be used for each eye. This means the elimination of dropper bottles. When not in use, the tray or table should be covered with a clean cloth.

Hands should be washed carefully before and after all eye treatments. When both eyes of a patient must be examined, the hands should be washed before examination of each eye. Remember, too,

the danger to your own eyes. Doctors and nurses in industry have frequently contracted epidemic keratoconjunctivitis, obviously from their patients.

When a patient comes in with an eye injury, it is desirable to place him on the table or in the chair immediately, and to instruct him to close his eyes *gently*. He should be told to fold his arms in order to keep him from rubbing his eyes while the physician, nurse, or first aider gets ready to take care of him. If he is asked to keep his arms folded during examination and treatment, he is unlikely to bring his hand to his eyes, thereby avoiding the possibility of knocking the hand of the person giving first aid, and causing serious damage to his eye.

After the patient is comfortably settled, the light and magnifying glass are adjusted and the cover is removed from the tray or table. The physician or nurse washes his hands and removes the covers from containers. In all cases it will be necessary to evert the eyelids to make a thorough examination. It is well, therefore, at this point to place several sterile cotton tipped applicators on a piece of sterile gauze or a sterile petri dish. Sterile lifting forceps (kept in special solution recommended by the ophthalmologist) should be used to remove such items from the sterile jars. It is also desirable at this time to pour a small amount of sterile water, saline, or boric acid, into a sterile medicine glass to be used either for irrigating purposes or for moistening applicators. This prevents the possibility of contaminating the solution in the bottle either in taking the solution from the bottle at a later period or through exposure to the air, since the bottle can be recorked immediately.

The eye is next examined carefully, the lower lid being drawn down for an examination of the lower cul-de-sac. Even when a foreign body is located and removed from the surface of the eyeball or the lower cul-de-sac, it is best to evert the upper lid to be sure there is not another hiding there. Most people find this easier to do if a cotton tipped applicator is placed horizontally across the lid and the lid is turned back over it. However some, who are dexterous in handling eyes, do it easily by turning the lid back over their thumb.

Foreign Bodies in the Eye

Many foreign bodies can be dislodged by directing a gentle stream of sterile saline solution or water to one side of the foreign body, and this is the safest method to use. A 10 cc syringe is most satisfactory for this purpose, but an eye dropper can be used. If this is not effective, a moistened cotton-tipped applicator can be tried. It is important that the cotton be tightly wrapped on the applicator. At the first attempt the foreign body should be touched with the applicator. If it does not come away, the applicator should be gently but firmly rolled across it. In using an applicator the hand should be steadied against the patient's forehead, or if the patient is on a table, the elbow should be steadied against the table.

If the foreign body still is not removed, no further attempt should be made, but the eye should be covered with a firm patch and the patient sent to an ophthalmologist. If an applicator is used, as described, to remove foreign bodies from the cornea, it will probably be necessary to instil a local anaesthetic, but this should *not* be done without written standing orders. Many ophthalmologists also wish the routine use of a stain (fluorescein) after removal of a foreign body from the cornea, to detect a possible abrasion. This, too, requires a written order. There are differences of opinion in regard to the use of patches, and here again specific standing orders are needed which will guide the nurse in their use. The nurse, of course, should be familiar with the opinions of local ophthalmologists regarding the use of patches; and should know the types of injury in which they may be indicated, and which require a tight patch or a loose one.

When a worker believes he has something in his eye but the nurse is unable to see any foreign particle, it is safest to send him immediately to an ophthalmologist. The foreign body may be up under the upper lid where it is not easy to see particles; or if it was sharp, it may have penetrated into the tissues without leaving an obvious surface wound.

With the increase in welding, flash burns are also a common problem. Such burns are often incurred by either the welder or his helper. Frequently this occurs not during the actual welding operation while safety equipment is being worn, but when masks

or goggles are removed temporarily and the rays from a neighboring worker's torch occasion the burn. Other workers than welders or their helpers may get burns in the same manner. Often the symptoms of the burn are delayed for several hours and not infrequently come on at home while the worker is sleeping. He is awakened with severe pain and tearing. The treatment for this, whether the onset is at home or in the plant, definitely requires standing orders which the patient or family can carry out under medical guidance. After such an attack the patient should be kept out of work for a day or two to permit symptoms to subside. The nurse or first aider should be familiar with the directions given the worker for relief of attacks occurring at home, and may receive also somewhat different orders for treatment of such cases as arise during working hours.

Standing Orders by Physician

From all of the foregoing it will be seen that standing orders are urgently needed for first aid care and that these orders should be approved and preferably drawn up by the ophthalmologists to whom the workers are referred for eye injuries. This may be managed by the plant physician, or he may permit the nurse to make direct contacts with the ophthalmologists. The latter seems preferable as it opens the way for the nurse to discuss frankly with the ophthalmologists what she feels competent to do in relation to her own background in ophthalmic nursing and what the limitations inherent to her working situation are—such as inadequate space or facilities. It also affords an opportunity for the nurse, following such frank discussion, to seek the ophthalmologist's assistance in securing any additional training which she needs personally, and in presenting to proper management personnel the need for essential policies and facilities.

Where first aiders give care to eye injuries during the hours in which no physician or nurse is on duty, it is well that separate written standing orders be prepared for their guidance. These should be based on first aiders' training and on the degree of responsibility which, in the opinion of the ophthalmologists, the plant physician, and the nurse, they can safely assume. Relationship policies involved in this are a problem to discuss with management.

First Aid and Compensation

Another problem which arises in relation to first aid concerns compensation. For this it is necessary to have a record of the visual acuity made with a Snellen test chart, and in some states the only Snellen chart approved for compensation records is that published by the American Medical Association. Naturally it is desirable that this record be based on a test given before an injury occurs, but where this is not done, a test should be given as soon as possible after the injury. Many industrial ophthalmologists stress that if no previous test has been made, it should be done before any solution or drops are used in an eye. Such a record will stand in court against claims that the eye was further damaged in the first aid room by solutions or treatments used.

Vision Testing

This introduces the subject of vision tests. For industry, the primary purpose of such tests is to evaluate the worker's eyes in relation to production. From this point of view, the eyes are tools and as such they greatly affect both production and safety. The ophthalmologist, the plant physician and the nurse, all of whom are trained to conserve health, recognize the importance of conserving sight not alone for efficiency of work but for the whole well-being of the individual. They appreciate fully that, important as are screening tests of vision, they are no substitute for a complete ophthalmological examination.

However, screening tests are widely used and, increasingly so, as industry comes to a better realization of the relationship between vision and efficiency in placement and in production on the job. As many nurses are responsible for giving some of these tests, a brief discussion of the tests most used, and their values and limitations, is pertinent here.

The Snellen test has already been mentioned as the only acceptable record for compensation in many states. This is also the most common test in clinical and office practice. It is easy to give, provided a few simple rules are observed in regard to distance, lighting, and prevention of memorizing, or "cheating."

These rules may be summarized as follows:*

1. The patient should be exactly 20 feet from the chart, or 10 feet if a mirror and reverse-reading chart are used.

2. The lighting of the chart should be constant, evenly distributed over the entire surface and as nearly as possible 10 foot-candles. The room lighting should be at least one-fifth as bright as that on the chart, and should be free from glares, especially near the chart.

3. To prevent memorizing, keep chart covered when not in use and do not allow waiting workers to sit where they can see chart. In giving the test, use a pointer or card with a hole in it and shift it so that the reader is required to read the letters or symbols in a different order than that in which they appear on the chart.

However, although distant visual acuity is the most important aspect of vision for most types of work, other visual abilities are more important for certain tasks, and the Snellen test measures only this one aspect of visual performance. For example, some types of fine work are done at very close range, sometimes as little as six inches from the eyes. For this, the ability to focus for near work is more important than to be able to see things clearly in the distance, hence near visual acuity must also be measured, as indeed it should be for every worker of middle age or older who does any kind of close work, however occasionally. Another important factor in visual performance is the ability to co-ordinate the two eyes, since on this rests the perception of depth. This is particularly needed for any type of work which involves moving objects. Both safety for the worker and his fellows and efficient work are at stake if a person with limitations of this function is placed in an occupation requiring depth perception. Methods of testing for this vary, but the most common—the cover test for muscle balance—is a stereoscopic device of some kind.

Then, as you know, some jobs require a good color sense, a function which is far more frequently limited in men than in women and which, recent studies indicate, is at its maximum between 20 and 50 years of age, often declining thereafter. Methods of

* For full instructions about vision tests in industry, write the National Society for the Prevention of Blindness, 1790 Broadway, New York 19, N. Y.

testing color vision are far from satisfactory, but those most often used are a series of color plates which require the discrimination of a pattern, or the yarn test in which colors must be matched.

None of these screening tests are diagnostic. They indicate only a limitation of a given function without in any way suggesting the cause of deficiency. None is perfect. They are definitely gross screening; that is, they may miss minor conditions but, if properly employed and interpreted, they detect the larger defects. It is for the examining eye specialist to determine the causes and the need and methods of treatment.

In recent years various screening machines are being increasingly used. The best known of these is the Keystone Telebinocular. The Joint Committee on Industrial Ophthalmology has just issued a report on this machine and its set of tests which points out certain limitations, and recommends that where this device is used, individual standards be created in each industry under the guidance of medical and ophthalmological staffs.*

If, then, a nurse is to assume responsibility for any kind of vision tests, she definitely needs the guidance of ophthalmologists. Few nurses have been properly taught how to test vision. The procedures, however, are purely technical and can be readily mastered; but interpretation is much more complicated. If this also rests with the nurse, she will need a great deal of help. Many large industries employ technicians whose duties are limited to making the tests, their reports going to eye specialists for interpretation. A similar procedure is desirable when the nurse is giving the tests.

Goggles

Nurses also incur problems in relation to goggles, or safety glasses, which is the preferable term. Often her first aid records are the first indication of the need of safety glasses. In this case she should analyze her records carefully to learn as much as she can about which particular departments or machines occasion the most eye accidents and what kind of injuries they cause. The National Society for the Prevention of Blindness, as a voluntary

* Council on Industrial Health. "The Keystone Telebinocular in Industry," *Journal* of the American Medical Association, October 30, 1943, Vol. 123, p. 558.

agency, provides information concerning policies for establishing a safety glass program; and the U. S. Government Printing Office publishes the "Head and Eye Safety Code," which shows how to select safety glasses in relation to particular hazards. Catalogues of optical concerns will give the prices for such equipment. This is all material for study by the safety department or committee and by management.

There is a great deal of detailed work in developing and conducting an adequate program of safety glasses. In most plants it is not usually the function of the nurse to assume major responsibility for this, but it is definitely within her scope to present the problem to the proper authorities within the plant and to co-operate in developing a working program.

Nurses in industry are doing a real piece of sight saving. Many are finding eye problems with which they are not prepared to cope. Two things are important here. First, no nurse should be ashamed of being unable to meet the many problems she sees, but every nurse should be willing to turn to proper sources for help and know what those sources are. The National Society for the Prevention of Blindness offers consultation services to assist nurses in building up local resources. Secondly, the nurse should recognize that sight conservation in industry is a shared responsibility. She cannot do it alone. The more she gets involved in technical procedures for testing vision or conducting a safety glass program, the less time she will have for duties which are more urgently her responsibility—health supervision and the care of the sick and injured. Actually she may contribute more to sight conservation by doing these well than by assuming too much responsibility for technical aspects of eye protection and the detection of visual defects. This is particularly true if she can use her daily nursing experiences to point out the needs, and thus she can co-ordinate her service with that of related departments such as safety and personnel.

The American Board of Ophthalmology in Relation to Prevention of Blindness*

Daniel B. Kirby, M.D., F.A.C.S.

GIVES history, aims, qualifications, and achievements of the American Board of Ophthalmology.

IN THIS year of 1943, we are engaged in a World War as we were in 1918, the year of your inception. It was my privilege to serve as a medical and surgical officer in the United States Navy during World War I. While on cruiser and transport duty on the Atlantic we brought back from France on one ship, 51 soldiers totally blinded by war injuries. We cannot estimate or even anticipate the number of our allies or enemies who will be so afflicted in this global conflict. We trust not too many. One of the great purposes of our Societies for the Prevention of Blindness should be to guide the nations in an unselfish manner so that there will be no need for future war.

Another comparative historical fact is that your Society was founded almost contemporaneously with the development of the American Board of Ophthalmology, the original expressed purpose of which was to wipe out any incompetency in the special practice of ophthalmology. Certainly if this could be accomplished, then an important victory over blindness in civil life would be effected. The past 25 years shows how well this has been done. It will be my purpose today as a member of the American Board of Ophthalmology to acquaint you further with its history, its aims and methods, and how it has helped to prevent blindness. It is important that the Societies for the Prevention of Blindness encourage and foster the work of the Board of Ophthalmology.

* Presented at the Twenty-fifth Anniversary of the founding of the Mexican Society for Prevention of Blindness, Mexico City, August 13-21, 1943.

The Need for Education in Ophthalmology

The prevention of blindness may be expressed in another way—the conservation of vision. To achieve this worthy object, the education of the lay public regarding the precious value of their eyes, their proper use, the preservation of their function, the correct hygiene, the avoidance of injury and infection, is very important. But more valuable has been the education of the general practitioner of medicine, of the nursing and other professions who have anything to do with the eyes—particularly the specialists in ophthalmology on whom all depend for research, examination, diagnosis, maintenance of health of the normal eye, the prevention of diseases, the conservation of vision, the prevention of blindness and the restoration of vision, whenever possible, through treatment of the afflicted.

The Stimulation of Education by the Societies for the Prevention of Blindness

The American, Mexican, and other Societies for the Prevention of Blindness have done much in all of these fields. They have even contributed to undergraduate and graduate medical education—as for example the cooperation of the American Society for the Prevention of Blindness in the course in the Graduate Study of Ophthalmology of the College of Medicine of New York University. It is a self-substantiating and foregone conclusion that the better the education, training, and experience of the medical specialists in ophthalmology, the better will be served, and carried out, the all-important programs of the various societies for the prevention of blindness. An uneducated, untrained, inexperienced individual who sets himself up as an eye specialist, inviting the public to entrust the care of their eyes to him, can do inestimable harm to their precious eyes and to the cause of the prevention of blindness.

The Stimulation of Education by the American Board of Ophthalmology

The American Board of Ophthalmology has been a great stimulus to graduate education and study of ophthalmology, and to advancement in teaching and research. The applicants for the certificate of the Board appear voluntarily for examination after proper preparation

according to the syllabus and prospectus issued by the Board. If successful in passing the examinations, the specialists are certified as safe for practice, safe in diagnosis and therapy and in ethical handling of their patients. They become diplomates of the Board and their names are published so that the public may have access to them. There is no legal status to the certificate and there has been no attempt to have special licenses issued by the various states, recognizing the diplomates or restricting the practice of others who do not have the certificate. However, there has been great moral suasion. Responsibility rests heavily on those who are not properly trained and who undertake the treatment of afflicted eyes when consultation and care by certificated specialists are available. The ordinary license issued by the various states for the practice of medicine permits all who are correctly registered to do any and all parts of medical practice. The chief deterrent to ophthalmic practice by the untrained is the fear of damages which may be inflicted in the courts for malpractice. The certificated specialist by his very knowledge is protected and in his ethical practice he is unafraid. He is able to give counsel regarding the conservation of vision and the prevention of blindness and to save eyes unfortunately afflicted by diseases or injury.

The Broad Aims of the American Board of Ophthalmology

The development of such a great organization and the coincident advancement of graduate education could come only in a free country with free enterprise. All who qualify are recognized regardless of race, creed, religion, social status, or professional connections. Those who prove themselves not sufficiently educated are given the opportunity to study more and are encouraged to meet the standards of the Board, provided they are honest and ethical in their practice.

The purposes, as listed by the Board, are:

1. To elevate the standards of ophthalmology.
2. To determine the competence of practitioners professing to be specialists in ophthalmology.
3. To arrange and conduct examinations to test the qualifications of candidates who appear before the Board for certification as specialists in ophthalmology.

4. To grant and issue certificates of qualification as specialists in the field of ophthalmology to candidates successful in demonstrating their proficiency.
5. To act as advisors to prospective students of ophthalmology.
6. To serve the public, hospitals and the medical schools by preparing lists of specialists certificated by the Board.

For further information about itself, the Board has a concise publication* covering the following points: origin, aims and methods; purposes; no degrees or legal restrictions; value of certificate; prerequisites; general requirements for all candidates; fees; special training; basic studies; clinical experience; what constitutes the examination—part I, oral; part II, practical and clinical; opportunity for re-examination; certification; and revocation of certificates.

Diplomates of the American Board of Ophthalmology Certified as Safe Ophthalmologists

Those who are granted the certificate are not expected to know as much as the professors of ophthalmology, to be equal to the most skilled practitioners or diagnosticians or to be as expert as the best eye surgeons, but they are to be regarded as safe for the average case in the average community. Out of those who are certified come the leaders, the research men who advance the knowledge of the profession, the professors who teach because they were taught and who love their work, the most skilled and sought after specialists in ophthalmology. There is no need at present for certifying these latter as experts. They are well known by all. There is a continued need for certifying the larger or safe group and for keeping up the standards of education, training, experience, and professional conduct before admission to examination and before giving out the certificate, and then to require the specialists to keep up the best standards of practice by retaining the power of revoking the certificate when necessary.

Some of the subjects covered in the examinations are: embryology and anatomy; histopathology of the eye and orbit; optics and visual physiology; refraction; ocular motility; external diseases of

* Obtained by applying to the American Board of Ophthalmology, 704 Congress Street, Portland, Oregon.

the eye; ocular therapeutics; ophthalmoscopy; medical ophthalmology and clinical pathology; bacteriology of the eye; neuro-ophthalmology and perimetry; and ophthalmic surgery.*

The American Board of Medical Specialties

The value of the far-reaching program of the American Board of Ophthalmology as the pioneer in this field has been recognized by the other specialities in the practice of medicine, and gradually one by one they have established their own boards. Finally, through the action of the American Board of Medical Specialties, the whole group was co-ordinated and the best interests of all served. The public may now be assured that, when they consult a specialist in a certain field of the practice of medicine, he will be qualified. This condition of excellence of practice could never have been brought about except through voluntary effort and through competition in a free state.

The Constitution of the American Board of Ophthalmology

The present constitution of the American Board of Ophthalmology provides for twelve members, four of whom are selected or appointed from each of the three societies—the American Ophthalmological Society, The Section of Ophthalmology of the American Medical Association, and the American Academy of Ophthalmology and Otolaryngology. Each member is appointed to serve for four years, at the end of which time he is either reappointed or succeeded by another member. The twelve members elect from their number a chairman, a vice-president, a secretary-treasurer and an assistant secretary-treasurer. Various committees are entrusted with important self-evident duties, as for example the Committee on Requirements, the Committee on Ethics, the Committee on Examinations and Arrangements, and others. A registrar works with the Secretary in doing much of the detail work. Examinations are held at stated published times twice or more during the calendar year, according to demands or applications.

The work of Drs. Edward Jackson, John E. Weeks, William H. Wilder, Walter B. Lancaster, and Allen Greenwood was outstanding in the founding and development of the American Board of

* *Syllabus.* American Board of Ophthalmology.

Ophthalmology. The certificate of appreciation engraved in honor of Dr. Edward Jackson bears the names of all of the members of the Board prior to October 8, 1939.

The Armed Forces, the various hospitals and colleges have found the certificate of the various Boards valuable in assaying the calibre of the medical officers, members of the staffs, or faculties. The certificate is required for appointment for special practice in many institutions. In this way there has been recognition of the value of the certificate. Without using any invidious comparisons with the methods of becoming specialists in former years, the stimulus of the American Board of Ophthalmology can be said to be an outstanding contribution to graduate education in ophthalmology in America and, because of its natural effect, to have been a great factor in the prevention of blindness.

Significance of Visual Defects in War Production Effort*

Hedwig S. Kuhn, M.D.

COMPARES results of industrial pre-placement examinations in 1943 with those conducted in 1940, showing that the "bottom of the barrel" for labor has been scraped in the past year.

VISUAL defects as they concern the war production effort prior to 1943 were mainly those within industry. As the demand for guns, tanks, planes, ammunition and ships grew, it was reflected in an increasing demand for special tempered steel, chemicals, precision parts, armor plate and alloys. More had to be produced by each machine unit; fewer mistakes were allowable; less waste of material was permitted; more sensitive inspecting was called for. A direct correlation was found in graphs showing the relationship between accuracy and visual perfection and between lost time accidents and defects in visual performance. Here and there over the country it became imperative to conduct a visual survey of whole industries in which vision played an important part in all units of production. In other industries it became imperative to conduct sectional visual studies of special key employees—such as assorters, inspectors, crane operators and fine-part assemblers. This quickened effort to evaluate the part played by eyes in war production brought realization that visual skills are of utmost importance not only in selection of men for the armed forces but in placement and selection of men and women in the war industries.

The detailed data previously discovered necessary in evaluation of an employee's visual ability was built into the preemployment and preplacement pattern: namely, determination of the

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minimum visual standards for the job and adherence to them. These standards were simple groupings of the basic visual findings according to the visual demands of job groups and included (1) uncorrected acuity for distant and for near vision, (2) acuity with the glasses habitually worn, i. e. work acuity, (3) muscle balance for distant and for near vision, (4) stereopsis and (5) color appreciation. To these basic findings, which designated a minimum amount of information, were added such special tests of near vision (e. g., determination of the near point of accommodation and of convergence), as might be needed in selecting eyes for exceedingly intricate work done within 12 inches from the eye.

VISUAL DEFECTS OF EMPLOYEES AND APPLICANTS IN 1940 AND 1943. THE PERCENTAGE OF EACH DEFECT WAS FOUND TO BE HIGHER AMONG PERSONS OVER 40 THAN AMONG THOSE UNDER 40.

These visual tests, which are simple and yet so much more complete and more accurate than had previously been considered needful, had been studied statistically in 1940. They were reflected in certain percentages and graphs worked out both for men already on the pay rolls of industry and for applicants seeking jobs in industry. As is shown in the accompanying graph, the percentage of defects of acuity, muscle balance, stereopsis and color vision were almost the same within industry as they were outside of industry, i. e., in the labor market of that day. This labor market of course reflected the type of civilian reserve from which industry

had to draw to increase its pay rolls. In a recently completed study of a war industry the same labor pool, or civilian reserve, was analyzed as of 1943, as well as the level of defects within industry as of 1943, and the results were compared with those of 1940.

TABLE 1.—VISUAL DEFECTS IN CIVILIAN LABOR POOL OR AMONG APPLICANTS

	1940	1943
Acuity unaided (naked eye)	18	34 (almost double!)
Working acuity (with whatever correction was worn)	14	23
Depth perception	18	26
Color appreciation	4	5
Muscle balance	16	23

The picture revealed as of today is indeed a startling one. Its significance in terms of the war production effort is of immediate concern. First, what everyone has sensed and what has often been stated as true without factual data to substantiate it has now been proved. Industry is indeed scraping the bottom of the barrel! In further analyzing the graph, one finds that the percentages of visual defects in Table 1 were found in the civilian labor pool, or among the applicants, in 1940 and in 1943:

In 1940 and in 1943 the employees already on the pay roll showed the percentages given in Table 2.

TABLE 2.—VISUAL DEFECTS AMONG EMPLOYEES

	1940	1943
Acuity unaided	21	26
Working acuity	12	18
Depth perception	16	28
Color vision	5	5
Muscle imbalance	22	24

The percentage of defects among those who had already slipped by the admission tests and were at work early in 1943 has risen slightly, but, most serious of all, *the percentage of defects in the unaided eyes of the slowly dwindling stream of civilian applicants has doubled.* This per se would not be so ominous if the percentage of defects among persons wearing their work correction was not also up, and almost to an equal degree. This means that not only has the task of further improving visual efficiency within industry be-

come greater, but the need of visual rehabilitation among the civilians of 1943 is very great. Salvaging of human eyes will become an even greater task in 1944 and 1945.

This problem immediately presents itself to the three groups that are most directly concerned. First, management, needing greater visual perfection in its increasingly complicated production skills, must be more vigilant than ever in the use of screening tests for its applicants. There are now many jobs where a person with a wooden leg or one arm can turn out top work. But the jobs where he does not need to see well are indeed becoming rare. In some industries management is searching the highways and the byways for persons to take over its new and idle machines. In other industries it is searching for labor to staff its gigantic new production lines. It is at this point that war production turns to the second group directly concerned, the highly trained experts who can help to salvage the eyes of those men and women, the third group, who are waiting at the gates and otherwise will be rejected.

In order to appreciate fully this gigantic problem one must recognize many new factors, but one especially, that in order really to salvage this most precious human commodity—vision for today's urgent need—it is necessary to find new, speedy and directly controllable methods of conservation. Formerly an indifferent "Go see some one about your eyes and come back—if you can pass the vision test, maybe we'll have a job for you" was the statement of the employment office. Now in many vital industries it is essential to find out immediately, often actually inside the plant, whether the man with 20/100 vision in each eye can have his vision brought to normal with glasses or the woman with 20/200 vision in the right eye and 20/20 in the left has an amblyopic right eye, optic nerve atrophy or macular retinitis. The latter can do her type of work with one eye, but has she a progressively ocular disease that will in due time affect her other eye? As the age level of applicants rises except for women and minority groups, the vigilance of the refractionist and the responsibilities of both the management and the ophthalmologist increase.

Men and women applying for war work form the group directly concerned. They come from among the ordinary civilians, the citizens of the home communities, many of whom have never

worked in industry. They have worked in stores and homes and supplied the many services of modern existence, or they have not worked at all. In fact, they can truly be said to constitute the rank and file of the practice of any ophthalmologist in city or village. They therefore reflect the whole range of ophthalmic diseases and troubles encountered in office practice.

The consulting ophthalmologist working with the industries he is responsible for has now to supervise with extreme vigilance the entire industrial eye program: treatment of eye injuries, eye protection plans, job standard evaluations and rehabilitation procedures. He must study the applicants turned over to a refractionist for routine correction through failure in the screening tests. As the age level rises and the Manning tables become operative he has also to search for glaucoma, for early degenerative retinal diseases, for early lenticular changes and for early hypertensive signs in the fundi. Many of the applicants are totally unaware that anything is wrong; many have never had any sort of ocular examination; the vision of many can be saved. However, all this is only a small part of the problem which has been laid so suddenly at the ophthalmologist's door. His vigilance must further extend itself. It must be carried into his private practice; he must assist local medical societies in setting up proper educational programs on the radio and in the newspapers, wherein people are urged to take care of their eyes for their own and their country's sake.

These facts lead to but one conclusion, namely that physicians in general have an exceedingly important and a direct responsibility in the war production effort. This responsibility is twofold. First, they must walk boldly out of their "ivory towers" and go directly to industry and offer their services. They must do this with an honest determination to be open minded and realistic. They must try not to let old stereotyped ways of doing things (even if these ways are good) interfere with their willingness to learn new ways, and quickly, if the occasion calls for them. This is a war, and it is their war. Management, labor, the farmer, the housewife and the 18 year old have learned new ways of doing things, and they have not always been pleasant ways. So too physicians need badly to loosen up their tight collar of hesitancies and worrisome fears and get to work on the problems that only they are trained to

solve, even if the new but necessary ways are unpleasant. To illustrate, I shall take an actual example—one industry and one day's group of 35 applicants who had been found to have sub-standard visual acuity in their original screening tests. These 35 represent according to statistics the average number of defects in acuity found for about every hundred persons "screened," namely about 35 per cent. The results of refraction were as follows: Of the 35, 18 who would otherwise have been left in class B were brought to normal with proper glasses and put into class A; 10 who would otherwise have been rejected conclusively were brought to normal with glasses and put into class A, and, 7 were rejected because of disease (for example, optic nerve atrophy, cataract, macular hemorrhage and old perforating injury of the eye).

In this particular war plant the visual standards had to be high because of the nature of the work—class A having 20/30 vision or better in both eyes. In terms of the war need, 28 of 35 applicants were salvaged immediately and put to work at class A jobs. Ten of these would undoubtedly have been lost entirely to this particular plant, at which they were applying, if they had simply been told to go get their eyes fixed. There are still too many jobs open where nobody bothers about whether or not the applicant sees well. Eighteen of these applicants would have been denied class A jobs, and management in this plant, needing top visually qualified workers most urgently, would not have been able to use these 18 men except as sweepers and janitors and in similar capacities. In this instance, of course, the ophthalmologist was working close to the day by day problems of the industry and was therefore actually responsible for equipping 28 of 35 men. This is the salvage figure for one day for one industry. Figured by the month, it means an average of 800 to 850 men and women given a chance to work by being equipped to meet the requirements. Such salvaging should occur day after day, month after month, in industry after industry, and it demonstrates how ophthalmologists can face their first responsibility by going forth to meet the needs of industry inside its gates.

The second great responsibility of the ophthalmologist is to make effective a newly conceived approach to the daily office routine and private practice. This is reflected by exercise of vigilance in:

1. Correcting refractive errors for the job, asking wives and 17 year olds who are now working exactly what they are doing and prescribing accordingly.

2. Using his previous knowledge, or acquiring what more he may need, so as to give orthoptic training for occupational objectives. For instance, the small parts assembly girl whose previous close work consisted in reading the latest best seller or sewing on buttons now does close work for eight to ten consecutive hours six days a week. She has an exophoria that gives her great discomfort and makes for many mistakes because of the blur produced. She can probably be fully rehabilitated by orthoptic exercises and good general medical treatment. A low hemoglobin content, a low basal metabolic rate, infected tonsils and abscessed teeth are luxuries in war-time.

3. Searching for incipient glaucoma; removing cataracts; discovering the real causative factor in a contact dermatitis of the lids (bran, oil, paint, chemicals); curing a stubborn chronic staphylococcic conjunctivitis which causes extreme annoyance in the glare of an inspector's spotlight; taking care of patients with foreign bodies, flash burns and other injuries quickly (ahead of private patients); sending workers with minor injuries back to work as soon as possible; keeping a sharp lookout for scattered cases of epidemic keratoconjunctivitis, and protecting the industrial worker by isolating the occasional infected school child or housewife, who might otherwise be the source of trouble for an entire plant.

4. Teaching parents how a neglected squint can keep Willie from flying a plane or perhaps being able to choose freely later in life a technical occupation in which binocular vision is essential. The ophthalmologist should take time and use pressure in "selling" what is in his honest opinion the right thing to be done.

These itemized particulars of course form only a part of the full picture with which every busy ophthalmologist is daily occupied. The objectives have had to become streamlined in order to meet the challenge of a nation of workers. There are few if any "drones" left in the hive, and their human counterparts had perhaps best be left sitting in reception rooms until the last.

Ophthalmologists do not need much more than an honest desire to learn something of industry's needs in the sphere of visual problems and a willingness to try to do things in new ways, new places and under new circumstances in order to take their proper and most important place on the home front. Visual defects are of real significance in the war production effort.

Recent Developments in the Prevention of Blindness Program

A Staff Panel Discussion

Mason H. Bigelow, President: Chairman

The staff describes some of its activities during the past year.

MR. BIGELOW: Annual meetings are traditionally occasions for a review of past performances and a glimpse at the road ahead. Instead of the usual type of report it was decided this year to have various staff members assist in bringing out certain highlights of the program. Some of you are familiar with the general pattern of the Society's work and know that the composite picture of preventing blindness and protecting eyesight includes numerous responsibilities. To cite a few: assisting local communities to organize programs and find qualified personnel; stimulating education of certain professional groups, such as nurses, teachers, medical social workers; assisting industry to safeguard the eyes of workers; promoting the early detection of eye diseases and conditions which may result in loss of vision; promoting the restoration of sight where possible; improving the standardizing of records, procedures and practices having a bearing on knowledge about eye conditions; promoting the establishment of educational facilities for children whose eye conditions make it impossible for them to use ordinary school equipment, as well as improving eye hygiene conditions in educational institutions, offices, factories and homes; providing educational material for the public at large.

Many of these activities are, of course, continuous. Some receive additional emphasis in times of particular need or opportunity. From time to time special projects are undertaken as demonstrations to set patterns for others to follow. Special atten-

tion has been given to at least two projects which we believe have far-reaching possibilities for preventing loss of sight. One is concerned with the dreaded eye disease, glaucoma, reported to be responsible for 11 per cent of existing blindness. The other is in the field of industrial eye health and protection.

Glaucoma

Perhaps it would be well to begin with these two aspects. In connection with the glaucoma project we have been fortunate to have the co-operation of Dr. Mark J. Schoenberg who, as chairman of our Committee on Glaucoma, has given most generously and enthusiastically of his time and knowledge to the advancement of this undertaking.

Dr. Schoenberg, for the benefit of those in the audience who may not be familiar with the medical terminology, will you tell us what glaucoma is?

Dr. Mark J. Schoenberg: Glaucoma is a disease of the eye which occurs most frequently in people over 40 years of age; it may affect one or both eyes. Its presence causes the eyeball to become harder than normal; this interferes with the health of the blood vessels, nerves and other parts of the eye which must function correctly in order to have good eyesight. There are two types of glaucoma—one which causes sudden severe pain, and the other, the more prevalent variety, is accompanied by symptoms so slight that they are often ignored. For this reason, a yearly eye examination by a competent eye physician is recommended for everyone over 40 years old.

Mr. Bigelow: What can we do about glaucoma? Can it be prevented?

Dr. Schoenberg: Yes, if adequate treatment is administered in the earliest stages of the disease; and if the treatment is carried on regularly as prescribed by the eye physician.

Mr. Bigelow: I know the Society is doing many things in the glaucoma program. Miss Smith, will you give us some idea of the day to day activities which are helping to make people aware of the dangers from glaucoma?

Miss Virginia M. Smith, Staff Associate: We are distributing educational material to the general public about the early symp-

toms of this disease, and informing people about the availability of medical services. To professional groups which may be in contact with individuals seeking medical attention, we are distributing pamphlets describing how to recognize and when to suspect glaucoma. Another important part of our job is to advocate the reorganization of eye clinics in such a manner as to make it possible to discover glaucoma patients and to treat them adequately while the disease is in its early stages.

MR. BIGELOW: Dr. Schoenberg, the activities of your committee began before the war. Hasn't this situation altered your program somewhat?

DR. SCHOENBERG: Yes, indeed! With the shortage of personnel, it is impossible to give glaucoma patients the time-consuming examinations necessary in order that treatment may be recommended. It is evident that such patients should, in any event, be cared for in special clinics, some of which have been established. One of these has been organized in New York City at the Manhattan Eye and Ear Hospital. We have trained a group of volunteers to assist the medical staff by measuring the pressure within the eye, charting fields of vision, and getting the necessary information about the history of the eye condition and the diet and health habits of the patient.

MR. BIGELOW: It is interesting to know that you have been so successful with the use of volunteers. Your Committee on Glaucoma is doing an extremely valuable job, Dr. Schoenberg, and you are certainly a trail blazer in this field.

Industrial Eye Safety

Everyone is concerned with the chief problem of winning the war. The tremendous activity in war plants is related to the problems of industrial safety. As a preliminary step toward the development of a program for the prevention of eye accidents, Mr. Tolman made a survey of a selected group of industrial plants and has been in contact with the leading industrialists and government officials carrying responsibilities for extensive production programs.

Mr. Tolman, will you give us a brief picture of your findings?

MR. CHARLES P. TOLMAN, Consulting Engineer: Practically all of the plants investigated are carrying out faithfully general safety

procedures such as the maintenance of first-aid facilities; employment of safety supervisors; enforcement of accident prevention rules. But often these same plants make inadequate provision for protecting eyesight and improving visual conditions. Obviously, industrial concerns need to give much more attention to the subject of industrial vision, not only for humane reasons, but for increasing production, reducing spoilage, and making more manpower available. One thing that can be done, for instance, is to provide prescription lenses to correct subnormal vision so that workers may be usefully employed in the war effort who would not otherwise be able to carry on their work efficiently.

MR. BIGELOW: Has any appreciable progress been made?

MR. TOLMAN: During the past year, there has been a growing recognition among government and public agencies as well as industrial concerns, that eye conservation is an important factor in practical management. Industry is beginning to accept our teaching that in all occupations requiring sight a man can work only as well as he can see, and that the eye conservation program as a whole can be expected to make a major improvement in productive results.

MR. BIGELOW: These are encouraging signs. Because of the recognized importance of this subject, in recent months the Society has had special co-operative relationships with the United States Public Health Service. For advancement of the program in the industrial field, this government agency has assigned to our staff an ophthalmologist, Dr. Joseph Lo-Presti, a Reserve Commissioned officer, to help in appraising the visual problems in industry and in developing procedures to solve them. Dr. Lo-Presti, what action is being taken in this important field?

DR. LO-PRESTI: In order to make the greatest use of manpower, there must be an analysis of the job and of the individual who is to undertake it. It has been found in many cases that if proper eye examinations are given, much better adjustments can be made. In order to have findings on which to base a program, it is necessary to make a number of studies for the purpose of developing methods of eye examinations and the means whereby existing difficulties can be overcome. The surveys of the working population that we are now planning will give us a clear index of existing conditions—what proportion of employees have faulty vision; what is being

done to correct this; what seeing conditions exist in the plant; and what can be accomplished in improving those that interfere with visual efficiency.

MR. BIGELOW: Have you a definite study planned?

DR. LO-PRESTI: Yes, we are planning a study of a typical industrial region in a concentrated effort to develop a pattern for investigation and methods that will show us how such pattern can be applied to the country as a whole.

MR. BIGELOW: It is evident that we are going about this in a practical manner. The industrial program is such an important part of our work that we need the help of many professional groups —safety engineers, industrial physicians, industrial nurses and others.

Are nurses taking an active part in this program, Miss Mumford?

MISS ELEANOR W. MUMFORD, Associate for Nursing Activities: That nurses are participating is shown by the fact that about 12,000 of them are employed in industry. Many of them have come into the field during the war and need our help to meet problems that are somewhat new to them.

MR. BIGELOW: On what kind of eye problems have these nurses sought our help this year?

MISS MUMFORD: The most frequent occasion for their coming to us is to find out what they, as nurses, should or should not do about giving first-aid in cases of eye injury when no physician is present. Many also want information about methods of vision testing and about the use and care of goggles. Of course, in large industries with highly organized medical and safety departments, the nurses carry much less responsibility, but in smaller establishments nurses make vision tests and are more or less responsible for goggles.

MR. BIGELOW: What, Mr. Tolman, do you consider was the major problem for the conservation of vision in industry during the past year?

MR. TOLMAN: Well, I think it is education, and education on two levels. One is the level for people who must in turn teach, and then the workmen themselves. The management has been very co-operative and the publications of the Society have been very well received.

One publication alone—Eyesight in Industry—has been circulated to the extent of some 25,000 copies, approximately 80 per cent of which were purchased.

I have on my desk a letter from the Internal Security Division of the Ordnance Department asking for 5,000 copies of the new manual and appraisal form, which will be distributed through fifty regional offices. We expect to get copies of the checked appraisal from many of them, which will enable us to further our activities.

Brief, intensive courses are being planned in order to provide industrial executives with needed information regarding their problems. Intensive courses are planned for colleges of engineering for faculty and students.

MR. BIGELOW: I was particularly struck by your comment that 80 per cent of a particular publication was purchased, because—not that the money is of such great importance, though none of us turn our backs on the sixpence today—but the fact is that if people buy things, they are going to use them. It is not a matter of distributing things that may or may not get to the right place.

Rehabilitation

Of course the ideal thing, as we all recognize, would be to look forward to a happy situation in which there would be no blind; but I suppose that none of us is quite optimistic enough for that, and so long as there are cases of blindness, we must look forward to methods for rehabilitating those whose sight has been impaired. Mrs. Merrill, what is the relation of the Society to that big problem?

MRS. ELEANOR B. MERRILL, Executive Director: The whole subject of rehabilitating the visually handicapped, whether they are victims of war or civilian casualties, is of great importance to our Society. As Dr. Lo-Presti and Mr. Tolman have suggested, because of the need for increased production, the employer must not only place every person in the job best suited to him, but he must also make use of the handicapped person so far as possible. This necessitates the most careful guidance in the selection of occupations in which the eye difficulty will not be a serious disadvantage or a hazard to co-workers.

MR. BIGELOW: Is the National Society taking any definite part in solving this problem?

MRS. MERRILL: Yes. In co-operation with a number of other organizations we are working out plans related to this whole problem which will be presented to state and local prevention of blindness organizations; and these, in turn, will contact their state rehabilitation offices. There are two main groups to be considered: first, the individuals with vision defects serious enough to be an important factor in considering the selection of an occupation; and second, the individuals with multiple handicaps, one of which is a visual defect. To provide these individuals with the guidance needed, it is imperative that the Society aid in the selection and stimulate the training of consultants who are specialists in this field.

MR. BIGELOW: That sounds like an activity that will become increasingly necessary after the war, Mrs. Merrill.

MRS. MERRILL: Yes, more and more attention must be paid to the visually handicapped—to children as well as to adults. Miss Kerby has been making some studies for a new committee recently formed, which is known as the Committee to Study the Problems of Children with Severe Visual Handicaps. It is under the joint sponsorship of the American Foundation for the Blind and our Society.

MR. BIGELOW: What is this committee doing, Miss Kerby?

MISS C. EDITH KERBY, Associate in Program Planning and Research: With the co-operation of the directors of schools for the blind, in a few states we have observed and interviewed the children in their classrooms and studied their medical and achievement records. From this evidence we attempt to build up a picture of each individual's unmet needs for corrective medical care, for educational adjustments, for vocational training, and so forth. At the same time, we are studying the community's ability to meet these needs more adequately either with existing facilities or with expanded or new facilities.

MR. BIGELOW: What do you hope to do with these findings?

MISS KERBY: We shall make specific recommendations that will indicate how we feel the problems may be solved in the particular states and elsewhere. Then the final stage (which may or may not become the function of this committee) is to demonstrate how the needs of these children can be more adequately met.

MR. BIGELOW: You spoke of "problems" to be solved. Would you care to cite one or two examples?

MISS KERBY: One is the case of the girl whose eye record showed that in 1935 the examining ophthalmologist suggested "operation of left eye offers hope of improvement" and again in 1940, that "operation would be very beneficial." But when the pupil was graduated from the school for the blind the operation had yet to be performed. Then, there is the case of the child who reads Braille, but with his eyes, in the classroom, and outside of it functions entirely as a sighted person. The problem is to know what to do in such cases.

Sight-Saving Classes

MR. BIGELOW: This is an extremely valuable project; and we shall all look forward with much interest to further developments of this new Committee to Study the Problems of Children with Severe Visual Handicaps. . . .

Speaking of children with severe visual handicaps naturally brings to mind the work we have been doing for so many years in promoting the establishment of sight-saving classes for boys and girls who have seriously defective vision. Is the number of these classes affected by war conditions, Mrs. Hathaway?

MRS. WINIFRED HATHAWAY, Associate Director: To some extent, particularly those classes that are affected by the lack of transportation facilities. However, to offset this loss several new classes have been formed. Moreover, this shortage has led to giving greater consideration to the possibilities of educating these children in rural districts and small areas.

MR. BIGELOW: How is the present shortage of school teachers affecting the program in sight-saving classes?

MRS. HATHAWAY: It is inevitable that, since teachers of these classes are selected because of their efficiency, they should also be sought for military service and in other fields. To meet this drain on personnel, two universities this summer arranged for special courses for the preparation of new teachers, and one university offered a workshop course for those already in service who wished to improve their efficiency and to develop special projects through individual or group undertakings. Not only were a number of new

teachers thus made available to take the places of those who entered some war service, but the interest shown by the second group indicated the very high standards considered necessary for this work.

Vision Testing

MR. BIGELOW: It seems to me that one of the greatest achievements of the National Society has been the steady increase in the number of sight-saving classes throughout the country, the training of teachers for this special field, and the widespread acceptance of this program in the educational work. Closely allied to this activity is the work that we have been doing in connection with vision testing among young children. Is there anything new in this direction which you could tell us about, Miss Mumford?

MISS MUMFORD: We are frequently asked for information concerning vision tests for school and preschool children, and recently we held a meeting on this subject which created a great deal of interest. Ophthalmologists, administrators of school and preschool health services and of prevention of blindness agencies, together with some of the Society's staff, spent a whole day discussing common problems in this field. We believe this will be very fruitful, and will point the way for the Society to give increased guidance in this aspect of the program. We know that there is a great deal of interest in this subject because of the many requests that we get for our vision testing charts.

Health Education in Sight Conservation

MR. BIGELOW: We must be reaching a wide variety of key people with our material, not only with vision testing charts, but with exhibits, films, and publications. Have we initiated any new projects along this line, Miss Janowich?

MISS ISOBEL JANOWICH, Editor and Director of Films and Exhibits: Early this year we started our new four-page quarterly, the *Eye Health and Safety News*. In addition, we published three important manuals—one for nurses, and two for industrial and safety personnel—as well as many reprints of special articles from the SIGHT-SAVING REVIEW.

MR. BIGELOW: What about exhibits at conventions, Miss Janowich?

MISS JANOWICH: We are trying to make our visual education program meet wartime needs, yet stay within our budget for this phase of the Society's work. During the past year, the subject of eye health and safety under war conditions has been the theme of our exhibits at various national and local conferences—for medical groups such as the American Academy of Ophthalmology and Otolaryngology; for safety and illuminating engineers represented by the Safety Congresses; and for social workers, as represented by the National Conference of Social Work. In addition, many exhibits were prepared for groups of teachers, nurses and others.

Incidentally, the use of our industrial talking slide film, "The Eyes Have It," has gained steadily. In the past ten months alone, over 200 prints were sold at cost, reaching hundreds of thousands of war workers.

MR. BIGELOW: I know that one conspicuous example of visual education in regard to our field is going to be supplied by our new motion picture, "Eyes for Tomorrow," which Mr. Resnick has been very instrumental in starting, with the co-operation and financial help of the Co-ordinator of Inter-American Affairs in Washington.

We are going to see that picture when we finish here, but, Mr. Resnick, perhaps you would like to tell us a little bit about that?

MR. DAVID RESNICK, Director of Public Relations: I think you will all find our new film exceedingly interesting. As some of you know, it was produced by the Society in collaboration with the Office of the Co-ordinator of Inter-American Affairs. Spanish and Portuguese versions of the film have also been produced—they will soon be ready for public showing—and these will be used by the Co-ordinator's Office in Mexico, Central and South America.

Inter-American Relationships and State Programs

MR. BIGELOW: The Society is co-operating with our Latin American neighbors in other ways, isn't it, Mrs. Merrill?

MRS. MERRILL: Yes, in a number of ways. You all remember, for instance, that Dr. Alvaro, of Brazil, was the principal speaker at our Annual Meeting last December. You may be interested in knowing that since his visit here we have arranged for two social workers from Dr. Alvaro's home city of São Paulo to take special

training at Washington University in St. Louis. Their expenses are being met by the Co-ordinator's Office. They are in St. Louis now, preparing for the work they will do when they return as medical social workers to São Paulo.

Also, I should like to mention here that we are in constant touch with the organized movements for prevention of blindness in the various countries to the south of us; we are carrying on this liaison service because the International Association for Prevention of Blindness, which was located in Paris for a number of years, has been unable to function since the war began.

MR. BIGELOW: I am glad you told us about the Society's "good neighbor" policy. How about our own state and local programs?

MRS. MERRILL: As you know, the National Society for the Prevention of Blindness has no state or local branches, but works with all organizations interested in prevention of blindness or conservation of vision.

This year the Society, through correspondence and field service, has assisted several states in finding personnel or in developing plans for service. Among the states which have set up new units with responsibility for statewide prevention activities are New Jersey, Texas and West Virginia. The State of Rhode Island is in process of drawing up plans for such a unit, and California is considering formulating a program.

MR. BIGELOW: It is very encouraging to know that in spite of the many limitations the war places upon us, particularly in the lack of qualified personnel, many states are developing worthwhile programs. About how many now have such programs?

MRS. MERRILL: Twenty-three states have either official departments or voluntary agencies to give leadership in preventing blindness and impaired vision. We try to keep in touch with these programs and be of assistance as needed.

Causes of Blindness Study

MR. BIGELOW: One of the articles in our by-laws says that we are supposed to "ascertain" the causes of blindness. This should be of particular importance in considering state programs. Do we actually know the outstanding causes of blindness in each state, Miss Kerby?

MISS KERBY: Not yet—but we are approaching that goal. Through the activities of our Committee on Statistics of the Blind, we have obtained data on causes of blindness for 100 per cent of the schools for the blind in 30 states. When the Social Security Board report is released (which should be any day now) we shall have data for adults on aid-to-the-needy-blind in 22 states; for 17 states we shall have both. Moreover, although only the state of New Hampshire has released data on its entire register of the blind, a number of other states are working toward this objective. Altogether, there are not more than 4 states from which no data whatever are available.

MR. BIGELOW: We seem to be making genuine progress in ascertaining the causes of blindness. But our real job is to *prevent* the loss of sight. Are the available data sufficient, Miss Kerby, to show whether there have been notable decreases or increases in any causes of blindness in recent years?

MISS KERBY: Data for the child-age group compiled annually for nearly ten years show gratifying decreases in causes of blindness due to communicable disease and to trauma. No similar analysis is possible for the older age group as yet, because the figures for adults represent only a single group study for each state made in a very recent year.

MR. BIGELOW: I should think the findings of your Committee on Statistics of the Blind would be very helpful to those new state programs that were mentioned by Mrs. Merrill a few minutes ago.

Mrs. Merrill mentioned that medical social workers from Brazil are being trained in the United States and will return to Dr. Alvaro's eye clinic. Miss Smith, will you tell us what the Society is doing to stimulate hospital social service in the United States?

MISS SMITH: On July 1 we completed demonstrations at St. Louis University and the University of Kansas Hospitals, undertaken for the purpose of showing the need for medical social eye work. The National Society for the Prevention of Blindness shared the salary of a social worker attached to the eye service of each institution for a period agreed upon by the hospital and the Society.

The Society encourages medical social work with eye patients through publication of articles and by conferences with ophthalmologists and with hospital personnel. It also acts as a clearing

house of information regarding the many phases of medical social eye work.

Publications

MR. BIGELOW: I am always surprised, in looking through our catalogue of publications, to see the variety of titles in that list.

Mrs. Hathaway, I understand you have been collecting the material relating to the education of the partially seeing child so that people interested might have easier access to it?

MRS. HATHAWAY: Yes, Mr. Bigelow, such a volume has just been published by Columbia University Press under the title, "Education and Health of the Partially Seeing Child."

MR. BIGELOW: It wasn't very long ago that we made similar reference to the new book on "Eye Hazards in Industry," by your brother of honored memory, Mr. Resnick. How is that book doing?

MR. RESNICK: Nearly 2,000 copies of "Eye Hazards in Industry" are now in the hands of safety engineers, ophthalmologists, industrial physicians, and other professional people concerned with this subject. Nearly 1,800 copies were sold and over 200 were distributed for review purposes.

MR. BIGELOW: Surely this book is fulfilling its purpose at a time of great need for authoritative information during the expansion of industrial production for the war.

Miss Schneider, I wonder whether the armed forces have shown an interest in any of the Society's material.

MISS REGINA E. SCHNEIDER, Secretary: Our records show that Army and Navy units in different parts of the country have requested publications and films. Most of the material called for has been on the subject of industrial eye hygiene but interest has also been shown in pamphlets on glaucoma and other eye diseases.

MR. BIGELOW: Can you give us an idea of the volume of publications distributed by the Society during the current year?

MISS SCHNEIDER: Figures are available for the first ten months. These records show a distribution of approximately 250,000 publications, consisting of pamphlets, posters and vision testing charts. In addition, distribution of our quarterly journal, THE SIGHT-SAVING REVIEW, and our newsletter, *Eye Health and Safety News*, has aggregated about 32,500 copies.

Office and Volunteer Services

MR. BIGELOW: All of this requires a great deal of work; Mrs. Merrill, will you let us in on the secret of "what makes the wheels go 'round"?

MRS. MERRILL: The Society is indeed fortunate in having a cohesive and co-operative clerical staff, under the guidance of Mrs. Helen B. Smith, who assists in the selection of office personnel and supervises the distribution of the vast amount of clerical work involved in carrying on our program. It is not necessary here to mention the high degree of thoughtfulness and tact which these responsibilities entail.

I want also to say that we have been most generously assisted by the volunteer services of Mrs. Marie Sterling and Mr. Harold R. Butler, who came to us through application to the Office of Civilian Defense. Miss Smith has already paid tribute to the volunteers in the glaucoma clinic.

Finances

MR. BIGELOW: Although we have not had time to go deeply into any one phase of our work, what we have said this afternoon gives some idea of its ramifications.

But all of these activities cost money. For the support of our program we are, of course, dependent on and indebted to public-spirited citizens. What, in general, is the Society's financial condition, Mr. Yoder?

MR. THEODORE O. YODER, Membership Secretary: A forecast presented at the meeting of the Directors this afternoon shows that, owing to the continued support of our members and donors, the Society is in a sound financial condition. I wish there were time to give you the figures, but these will appear later in the financial statement of our annual report.

MR. BIGELOW: How many members and donors has the Society?

MR. YODER: We now have on the active rolls approximately 26,000—an increase of 2,500 during the past twelve months. Indeed, the year 1943 promises to be the best since 1930.

MR. BIGELOW: That is a most encouraging outlook, Mr. Yoder. Any organization must have a firm financial basis if it is to give the service for which it was established.

Editorial

Better Late Than Never

WE regret exceedingly the delay in the appearance of THE SIGHT-SAVING REVIEW, but must claim that it is, in a sense, a war casualty.

It is needless to point out the demands of wartime emergencies on the medical and nursing professions, and on industrial, social work and educational leaders; and it is on these leaders that the REVIEW depends for articles and for guidance. Because of our recognition of the claims which are made on these busy people engaged in war or civilian services, we have felt that it would be unfair to press them for material for specific dates, and have therefore awaited their convenience.

Despite delays, we feel that what they give is worth waiting for, and we promise that all subscribers will get their full number of issues per volume.

The Forum

THIS section is reserved for brief or informal papers, discussions, questions and answers, and occasional pertinent quotations from other publications. We offer to publish letters or excerpts of general interest, assuming no responsibility for the opinions expressed therein. Individual questions are turned over to consultants in the particular field. Every communication must contain the writer's name and address, but these are omitted on request.

The Organization of the Social Service Department of the Massachusetts Eye and Ear Infirmary

Editor's Note.—The following report on the organization of the Social Service Department of the Massachusetts Eye and Ear Infirmary was sent to the National Society for the Prevention of Blindness at its request for the purpose of illustrating to another hospital the development of medical social service in an eye clinic. It is a factual statement of the way the Social Service Department functions at the Massachusetts Eye and Ear Infirmary and is not presented as ideal in any way. The National Society for the Prevention of Blindness believes it may be of interest to other Eye and Ear Hospitals or Eye Clinics which may be interested in developing medical social service, and presents the material for that reason.

The social service department is an integral part of the Hospital and the director of social service is directly responsible for the administration of the department to the Director of the Hospital. An advisory committee is appointed by the board of managers. This committee consists of two members of the board of managers (one of whom serves as president of the committee), two staff physicians, and two members of the ladies' visiting committee of the Infirmary. In addition, the director of the infirmary and the assistant to the director are present at the meetings. Chiefs of both the ophthalmological and the otological staffs are invited to attend also. The members appointed by the board of managers serve for a period of one year. The advisory committee is scheduled to meet four times a year. The director of social service is free to bring before these meetings any matters of policy, planning, change of organization, new undertakings, reviewing of functions of the department, etc., upon

which she wishes discussion and advice.

Direct planning for service to patients is done mainly with the chiefs of the medical services, but changes are often presented to the advisory committee for discussion and approval before putting them into effect.

Personnel

The complete social service staff consists of a director, an assistant director, six caseworkers, one follow-up worker (who also assists with stenographic work) and two stenographers. The eye clinic has the full-time service of four caseworkers. This is for a clinic whose latest published statistical report (1942) showed 7,132 new patients admitted during the year, and a total of 46,948 clinic visits during the year. Patients admitted to the eye ward in 1942 numbered 2,034 and are all included in the above figures, since all ward patients are admitted through the clinic.

Organization of Work on Eye Service

A social worker is assigned to take referrals from the clinic each day, the same worker carrying the patient socially if the patient is admitted to the ward. (No worker is assigned to the wards, as such; all workers do both ward and clinic work.)

One worker takes only patients with a diagnosis of glaucoma, and has responsibility for these patients in both the clinic and in the wards.

Referrals

There is no fixed rule as to how patients are referred to social service. A combined method of referrals from doctors, nurses, administrative officers, and outside social agencies, as well as selection by the social worker, is used. The selection by the social worker, however, is usually selection within diagnostic groups which the ophthalmologists have agreed should be referred to social service because they present a potential social problem, e.g. glaucoma, tuberculosis, trachoma, interstitial keratitis, gonorrheal ophthalmia, diabetes, and all malignancies.

If by error, or oversight, a patient with one of the above diagnoses is not referred, the ophthalmologists expect the social worker to take responsibility for drawing the patient to their attention. Other diagnostic groups considered for referral are uveitis, iritis, optic atrophy, toxic amblyopia, separated retinas and patients with low vision (adults 20/200 or less in both eyes; children with 20/70 or less in both eyes). In these latter groups, however, referrals are made with more selectivity in terms of a particular patient's social need than on the basis of the diagnosis. We are attempting to have referrals made from the medical staff as consistently as possible, as we believe working relationships

with the ophthalmologists are more soundly established by this method. To use this method exclusively is not possible nor practical under present conditions, however.

The social workers are not concerned with follow-up of medical treatment (except on glaucoma) unless some additional service to the patient is needed. Patients with trachoma, interstitial keratitis, gonorrheal ophthalmia, etc., are followed until their eye treatment is completed, but in practically all of these cases, social treatment is being given at the same time that they are coming for medical treatment.

The social worker for the glaucoma patients, however, is in charge of the follow-up program for glaucoma, and carries that program with the help of the follow-up worker and volunteers handling the mechanics of sending follow-up cards and keeping the file up to date. Each new glaucoma patient is reviewed by the social worker, routinely, to determine whether or not social treatment is indicated in addition to follow-up.

Records

Three types of records are used in the department:

(a) A fully recorded social record which is used for patients who need extensive social treatment. This record is kept with full identifying information in the social service files.

(b) A summarized record which is a social service sheet attached to the medical record stating the reason for referral, the social information obtained and a summary of the action taken by the social worker and showing the disposition of the case. These sheets are typed and signed by the worker. A sheet of this type theoretically is placed on the record of each patient known to the Social Service Department, even though there may be a much fuller record in the Social Service Department files.

(c) The third form is a card which contains identifying information and financial data which is used for patients whose only service from the social worker is arranging for payment for glasses or prostheses. This is kept in the Social Service Department files.

Qualifications of Social Workers

Our standard of employment of social workers on the Eye Service is basic training for the medical social field, i.e., two years of graduate study in accredited schools of social work where preparation for medical social work is given. Whenever possible, we encourage workers to take special training in eye work, such as courses planned for eye workers by the National Society for the Prevention of Blindness. When this is not possible we have arranged for special lectures by members of our own ophthalmological staff. Workers should all be qualified for membership in the American Association of Medical Social Workers.

Teaching

The department considers one of its functions the field work supervision of medical social master students, and has one or two in training most of the time. One lecture of fifty minutes is given on medical social aspects of eye conditions to student nurses who affiliate at the Infirmary for a two months' period. There is no regular formal teaching with the internes, although formal lectures on medical social problems in eye conditions have been given in the past.

Community Relationships

Social service staff members are encouraged to become members of committees related to children's problems, rehabilitation, prevention of blindness, problems of the blind, and others which would promote their own development and growth.

—EUNICE W. WILSON
Boston, Mass.

Note and Comment

Society's New Motion Picture on Prevention of Blindness Released.—An addition to the growing number of motion pictures in the field of health education is EYES FOR TOMORROW, a two-reel film, produced by the Emerson Yorke Studio for the National Society for the Prevention of Blindness, 1790 Broadway, New York City. Alois Havrilla is the commentator for the picture.

EYES FOR TOMORROW stresses good general health as a prerequisite for good eyesight. It also deals with the importance of prenatal care as a means of reducing the amount of blindness caused by syphilis and gonorrhea; the conservation of vision among school children; the use of sight-saving classes for children with seriously defective vision; the necessity for regular eye examinations; methods of treating glaucoma and trachoma; and the eye hazards of industry.

The film, in 16 and 35 mm., will be distributed in the United States by the National Society for the Prevention of Blindness. Prints in 16 mm. are offered for sale at $50, or rental at $5 per day, exclusive of time in transit. A slightly altered version, with Spanish and Portuguese sound tracks, will be released throughout Latin America under auspices of the Office of the Co-ordinator of Inter-American Affairs.

Oxford University Takes Up Prevention of Blindness.—Announcement has been received of the founding of a department of ophthalmic research at the University of Oxford. The aims of the department are the prevention of blindness, improvement of treatment of eye diseases, and the promotion of a higher standard of visual function throughout the country.

Many specific objects of study are listed in the notes on "Eyesight and National Health" published by the University. Among the points mentioned are: cataract and glaucoma, accounting for 70 per cent of blindness in later life, especially need biochemical research; the high incidence of "defective vision and squint" (20

per cent) in London elementary schools, as discovered by a 1937 survey, contrasting with 13.2 per cent in rural children; problems of nutrition affecting vision; hereditary blindness; night blindness; eyesight protection in industry; and the value of orthoptics.

Further information may be obtained from Mrs. deBoisse, Secretary of the Ophthalmological Research Endowment Committee, c/o University Registry, Oxford, England.

American Board of Ophthalmology.—Effective January 1, 1944, the Executive Office of The American Board of Ophthalmology was moved to P. O. Box 1940, Portland 2, Maine. The Officers for 1944 are: John Green, M.D., Chairman; Frederick C. Cordes, M.D., Vice Chairman; S. Judd Beach, M.D., Secretary-Treasurer; and Theodore L. Terry, M.D., Assistant Secretary.

The 1944 examinations will take place in New York City, June 3, 4; and in Chicago, October 5, 6, 7.

About Glaucoma.—Mount Sinai Hospital eye clinic, New York, is organizing a special service for glaucoma patients; this service was stimulated through the efforts of the Society's Committee on Glaucoma. Dr. Mark J. Schoenberg, chairman of this committee, recently took part in a Forum on Glaucoma arranged by the Philadelphia Committee for the Prevention of Blindness.

The tonometer checking station, located at the Society's office, which is working towards standardization of tonometers as part of the campaign against blindness from glaucoma, reports that thus far ninety-seven of these instruments have been submitted for checking by eye physicians in various parts of the country, who have been sent reports on the condition of their tonometers.

Pan-American Congress of Ophthalmology.—The Second Pan-American Congress of Ophthalmology, which was cancelled in 1943, is scheduled for November, 1944, in Montevideo, Uruguay.

The scientific program already announced stands unchanged, one day being dedicated to each of the following Sections:

1. Social ophthalmology—official reports of Commissions for Prevention of Blindness and Against Trachoma in America.
2. Research in ophthalmology—dedicated exclusively to experimental and laboratory investigation in ophthalmology.

3. Medical ophthalmology—The Internal Committee of Scientific Organization has chosen four papers on glaucoma:

a. The Preglaucomatous state, its diagnosis and treatment.
b. New Ideas on Glaucoma Derived from Gonioscopy.
c. Estimation and Mechanism of the Destructive Effects of Ocular Hypertension.
d. Surgical Intervention in Glaucoma—How Far Can Medical Treatment Be Continued.

4. Surgical ophthalmology—three papers on strabismus are on the program:

a. Surgical Treatment of Paralytic Strabismus.
b. Surgical Treatment of Heterophorias.
c. Surgical Treatment of Concomitant Strabismus.

There will also be papers on subjects elected by delegates. The Congress being tri-lingual, a summary of each paper in one of the two other languages will be projected on a screen while the paper is read in its original tongue, so that all may participate in the after-discussion.

The First Congress was held in Cleveland, Ohio, in October, 1940, when meetings of the International Congress were suspended because of the war. Attending were 240 ophthalmologists from United States and Canada, and 25 from the Latin-American Republics. President of the Congress is Dr. H. S. Gradle of Chicago; Exècutive Secretaries are Drs. Moacyr Alvaro of São Paulo, Brazil, and Conrad Berens of New York City. Chairman of the Committee on Prevention of Blindness is Dr. F. Belgeri of Buenos Aires. The official journal of the Congress is *Ophthalmologia Ibero-Americana*, published quarterly in Brazil, under the editorship of Dr. Alvaro.

Society Issues Industrial Manual.—On the basis of the findings of its study of fifty representative industrial plants (described in the SIGHT-SAVING REVIEW, December, 1942, p. 244), the Society has published a *Manual for Use with Industrial Eyesight Protection Appraisal Form*. This eight-page publication describes simply and briefly the necessary eye-saving facilities which should be available in every industrial plant, providing definite answers to the twenty-six questions appearing in the "Industrial Eyesight Protection

Appraisal Form." Single copies of the *Manual* will be sent to anyone indicating an interest in the subject.

School Health Service Report Form.—Readers of the REVIEW, especially those engaged in school health services, will be interested to know that the National Organization for Public Health Nursing has recently released its new "School Health Service Daily—Monthly Report Form," together with instructions for using it.

The form, which has been under consideration for four years, was tried out in various places before it was finally printed. It is designed for use by the nurse doing school work as a part of the general eye program, and by the specialized school nurse. This record form includes, of course, the subject of vision testing.

Ophthalmology in the War Years.—Under the editorship of Dr. Meyer Wiener, a two-or-more-volume work on the literature of ophthalmology during the war years, is planned. The first volume is to cover the period starting with the beginning of the war in 1940, until January 1, 1944, and the second volume will continue until after the cessation of hostilities, when there will be a free exchange of medical literature.

In the pursuit of material, Dr. Wiener is requesting, for review purposes, any works on or pertaining to ophthalmology or of interest to the ophthalmologist.

According to the plan, there are to be two separate aspects to the volume, as follows: (1) Running comment upon the outstanding contributions, going into such detail as is necessary for complete comprehension or for utilization as reference. Simple case reports or reviews or articles that do not contribute anything new will not be mentioned; (2) Bibliographical listing of all articles, but without comment.

The work was undertaken upon the recommendation of the Ophthalmologic Section of the National Research Council, at the request of Sir W. Stewart Duke-Elder, Williamson-Noble of Great Britain, Lieutenant Colonel Derrick Vail, the consulting ophthalmologist to the American Expeditionary Force, and a number of other prominent American ophthalmologists.

Current Articles of Interest

Night Vision, William John Holmes, M.D. (Honolulu, T.H.), *Archives of Ophthalmology*, August, 1943, published monthly by the American Medical Association, 535 North Dearborn Street, Chicago, Illinois.

Dr. Holmes, noting that relatively little attention has been paid to ocular function at minimal intensities of illumination, urges intelligent co-ordination of lighting principles with fundamental ophthalmological concepts in dealing with wartime lighting problems. Stress is laid upon the desirability of investigating the ability to discriminate detail and recognize lights throughout the visual field, instead of merely measuring speed and range of dark adaptation.

The ability to see in dim light is determined by (a) visibility of objects, (b) ocular, (c) systemic, and (d) psychologic state of the observer. These factors are discussed in turn.

The discussion closes with description of a few of the more generally recognized methods of examination for night vision, with a list of definitions of lighting terms.

The Parents' Role in Orthoptic Training, Frances Walraven. *American Journal of Ophthalmology*, November, 1943, published monthly by the Ophthalmic Publishing Company, 837 Carew Tower, Cincinnati, Ohio.

Miss Walraven stresses the importance of parents' fully understanding the meaning of binocular vision and technique of exercise, and of their appreciating the fact that length of treatment varies with the age of child, his age at onset of strabismus, and length of tenure of strabismus. Occlusion, partial or complete, is sometimes necessary, and the child's attitude toward it will reflect that of his parents. Concentration on the child's part is a sine qua non of success, and that concentration is stimulated principally by full and understanding co-operation of his parents.

Book Reviews

EDUCATION AND HEALTH OF THE PARTIALLY SEEING CHILD. Winifred Hathaway. New York: Columbia University Press, 1943. 216 p.

For years we have been looking for a publication that would bring into one volume material relating to the education of partially seeing children in the United States. Valuable articles, pamphlets, and parts of books dealing with this field there have been in abundance. But the one book that would tie together all important information the student of partially seeing children and sight-saving classes needs has been lacking.

Now we have that book. In *Education and Health of the Partially Seeing Child*, Mrs. Hathaway has made a basic contribution to the literature on exceptional children. The fact that she discusses both "education" and "health" is significant, for the two necessarily go together in dealing with the child who has only partial vision. Eye health and mental health are especially important; and these in turn are closely related to general health.

The book is appropriately divided into 4 parts, dealing respectively with (1) historical background; (2) administrative responsibilities; (3) educational responsibilities; and (4) community social services. It should thus be helpful to administrators, supervisors, and teachers; to educators, social workers, and nurses; and to all others who are interested in the total welfare of handicapped children. The technical value of the book is further increased by the 5 appendices, treating in turn: (1) facts about the eye and eye hygiene; (2) methods of vision testing; (3) desirable equipment and lighting facilities in the classroom; (4) sources of equipment; (5) vocabulary of terms relating to the eye. A selected bibliography of basic texts and a list of sources of material conclude the volume.

Administrative planning for partially seeing children, the author points out, should not be limited to the elementary school but should include provisions on junior and senior high school levels. Nor should it be restricted to urban areas. Partially seeing children in small communities and rural areas are quite as much in need of special attention as their city fellows, and several different ways

in which appropriate arrangements can be made for them are suggested.

Methods of conducting and financing sight-saving classes are discussed in detail. The author holds that "unnecessary segregation of any group defeats" the purpose of modern educational objectives. She therefore advises a co-operative program, whereby partially seeing children participate with other children in regular classroom work not requiring close use of the eyes, and work in a specially equipped room and with a specially prepared teacher on lesson assignments and problems with which they need help. Co-operation with and by the parents on all matters affecting the child's welfare is stressed as one of the essential elements of the program.

The author speaks with authority as one who has pioneered in the education of partially seeing children, and she has had a large part in the guidance of the movement to its present proportions. With 9,000 children provided for in 631 special classes, in 31 States, the Territory of Hawaii, and the District of Columbia, one has reason to be encouraged at the progress that has been made since 1913, when the first class for partially seeing children in the U. S. was established in Boston. But, as the author points out, there are some 50,000 more children waiting for help, struggling along as best they can with seriously defective eyesight, in the regular grades, in institutions, or not in school at all. On the road ahead, the author sees the school of the future administered and equipped so that *every* child will receive the type of individual treatment which he needs. But until that time comes—and even when Utopia is reached—such books as this will be most helpful in guiding educational procedures for children with special problems.

—Elise H. Martens, Ph.D.

Fit to Fly. Malcolm C. Grow, M.D., Lt. Col., Medical Corps, United States Army; and Harry G. Armstrong, M.D., Captain, Medical Corps, United States Army. New York: D. Appleton-Century, 1942. 387 p.

The book "Fit to Fly" is written by two experienced observers in the field of aviation medicine, Lt. Col. Malcolm C. Grow and Capt. Harry G. Armstrong.

Among the many important aspects of aviation medicine dis-

cussed are the following: the procedure of the various examinations including that of the eye; mental hygiene; the use of stimulants; disease of the heart; examination of the nervous system; flying fatigue; protective devices; sensory illusions in flight; aviation accidents; the effect of lack of oxygen on aviators and the use of oxygen by aviators; and an excellent chapter on first aid.

In writing the book the authors kept in mind those who are considering flying and those who are actually beginning to fly, as well as the veteran flier. Although the book is written in a somewhat popular style and will, therefore, be read with understanding by any one interested in aviation, the data is scientific and the authors have brought their varied and wide experience into the writing of the text.

Those interested in the eye will be especially stimulated by the chapter on the care of the eyes, in which the authors take up the prevention and treatment of external diseases of the eyes, including pink eye and other inflammations of the mucous membranes of the eye. Attention is given to burns and injuries as well as to the prevention and treatment of diseases of the interior of the eye. Especially important is their discussion of defective night vision. They also briefly describe the correction of errors of refraction and the treatment of eye muscle imbalance.

A great deal of attention is also given to the eye examination and to disqualifying defects. In the eye examination they take up the requirements of the pilot, combat observer, balloon pilot, and other technical personnel and outline the disqualifying defects, especially of visual acuity, depth perception and eye muscle imbalance. Especial attention is given to color vision, accommodation and the field of vision.

Another section of importance is that of sensory illusions in flight, in which they treat optical illusions from clouds and sensation of climbing when turning, as well as other illusions.

The section on fatigue in flight is well covered and of course is of importance so far as the eyes are concerned.

The last section on tropical diseases is of great value because of the increasing international character of aviation with the danger of exposure of flying personnel and travelers to unusual tropical diseases.

Although the text is well illustrated, more illustrations would have made the book, which is most interesting and easy to read, even more instructive.

—Conrad Berens, M.D.

The Vertebrate Eye. Gordon Lynn Walls. Bloomfield Hills, Mich.: Cranbrook Institute of Science, 1942. 785 p.

This is an excellent work on the vertebrate eye and its adaptations to function. These data must necessarily come from the special fields of zoology and physiology, to say nothing of ophthalmology. It is very unusual to find them so well co-ordinated in a single book without falling back on the jargon common to each specialty. Walls has accomplished this very nicely by the simple expedient of explaining his subject matter in very simple terms, defining the more unusual ones wherever necessary. As a result, the whole book is easy reading, especially when one considers the heavy subject matter that is sometimes presented.

The book has been divided into three main parts. The first part has been called "Basic" in which elementary facts have been set forth. Part II explains the effect of the environmental factors in the development of the vertebrate eye. Part III "Traces the history of the eye, group by group, from the lowest living vertebrate to the highest."

The whole book is well put together. The type is clean and the illustrations are excellent. Especially careful attention has been paid to the index and glossary.

Every ophthalmologist would do well to read this book, not only for the purpose of clarifying his thoughts upon some of the basic information about the vertebrate eye, but also to broaden his understanding by getting away from the narrow confines of human ophthalmology.

—Willis S. Knighton, M.D.

Essentials of Industrial Health. C. O. Sappington, M.D., D.P.H. Philadelphia: J. B. Lippincott Co., 1943. 626 p., il.

While Dr. Sappington does not treat any one aspect of industrial health exhaustively, he has covered the field comprehensively. In

this comparatively small volume he has presented in an orderly fashion those phases considered essential for an understanding of the present status of this field and of the direction in which future advances will take it. The three parts, Industrial Health Administration, Industrial Hygiene and Toxicology, and Industrial Medicine and Traumatic Surgery, furnish a complete review for the experienced industrial hygienist and an account of the subject which will prove extremely valuable in orienting the beginner in this already complex field.

The material on industrial vision, even for a work of this size, does not seem ample or sufficiently emphasized. Allusion and no more is made to pre-placement examination, and none to visual job analysis; the important subject of illumination is merely mentioned. Toxicology, as it affects eyes, has not been separated from the usual categories and glossaries listing toxic compounds in the orthodox way. Doubtless, others engaged in special aspects of industrial hygiene might feel that their own subject has been similarly handled. This probably only emphasizes the chief virtue of Dr. Sappington's book—presentation of essentials in a vast field for orientation purposes.

—Joseph Lo-Presti, M.D.

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These papers were presented at a Seminar on Industrial Aspects of Ophthalmology given by the National Society for the Prevention of Blindness in the Spring of 1944. They will be included, together with a number of others, and extensive discussion, in a 144-page volume, to be published by the National Society for the Prevention of Blindness under the title, "Industrial Aspects of Ophthalmology—Seminar Proceedings."

Importance of Industrial Ophthalmology

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CONSERVATION of eyesight should be an integral part of an industrial health program. Such a program should include more than prevention and treatment of accidental injuries to the eyes, for unrecognized chronic conditions of the eyes of employees and disregard for visual demands of particular jobs leave unremedied much that affects the health and efficiency of the worker.

An appalling picture is painted by Cozzens[1] when he states that industry in this country is losing or repairing 200,000 eyes annually at a yearly cost of $50,000,000, with 8,000,000 man-days being lost each year as a result of industrial eye accidents. He states, moreover, that 72 per cent of these accidents occur on supposedly nonhazardous jobs. Yet in a study made of 50 plants[2] employing in all over 165,000 workers, it was recorded that 98 per cent had safety programs and 94 per cent had safety supervision. If we may assume that these percentages are true of industries in general, then we must further assume that protection of eyesight through these safety programs has been inadequate.

Protective goggles against flying particles, fumes, and glare are being rather widely used but still not as extensively as they should be nor is the wearing of these devices sufficiently enforced. Protection against accidents is only one factor, however, in the conservation of eyesight. Diagnosis of eye defects and job analyses defining visual requirements are equally important factors.

Visual acuity, depth perception, muscle balance, color discrimination, all are qualities of perfect vision, but most jobs do not demand this perfection. A worker deficient in any one of these qualities may be sufficiently equipped for a number of jobs in a plant but be entirely unfit for work that demands particular visual qualifications. To place a worker with defective vision in such a job, without

proper analysis of his condition or of the requirements of the job, is to jeopardize the health of the worker and the quality of his work. Furthermore, eyestrain in a worker thus improperly placed, leads to early fatigue with decreased production. There is, therefore, double wastage, waste of manpower and of materials.

In addition to this waste, there is with such a disability, an increased liability to accidents. Dr. Kuhn,[3] in her recent book on industrial ophthalmology, states that in a survey of one year's lost-time accidents in a plant of 9,000 employees, it was found that these accidents had a direct relationship to visual defects. This is a serious condition, as Dr. Kuhn says, in industry "where less than top capacity production or unnecessary waste of critical material is almost sabotage."

I am sure that all these observations and many more in finer detail have been brought to your attention during this Seminar, and I repeat only to emphasize that the care of the eye should and must be included in our total industrial health program. We see practically every specialty of medicine participating in this work and correlating the findings (the latest to my knowledge is the psychosomatic group), so why neglect industrial ophthalmology? "The need for ophthalmologic service in industry is seemingly as great as is the acknowledged need for medical, dental, and nursing service" —to quote from Assistant Surgeon General R. C. Williams' paper.[4] One of the old slogans in promoting physical examinations of school children as part of the school hygiene program was "the whole child goes to school—his body as well as his mind." In like vein we can say a worker takes his eyes to the plant as well as the rest of his organic makeup of concern to the industrial physician. To cope with this problem an ophthalmologist must know industry, the hazards involved, labor-management relationships, and many other things of which the private practitioner has no knowledge.

If, as we have said, proper placement of workers with impaired vision requires an understanding of jobs that they can adequately fill, then the industrial ophthalmologist in addition to his thorough knowledge of vision and his training in treatment of eye diseases and correction of deficiencies of sight, must familiarize himself with the many jobs within the plant and their visual requirements. In co-operation with the medical department, it is his function to es-

tablish eye standards in that industry and advise in the proper placement of handicapped workers.

You know, as ophthalmologists, that eye conditions are often symptomatic of systemic disorders that may be remedied or may incapacitate the worker for the job he is about to undertake. The eye at times does warn of serious conditions present or pending. It is in the interest of both labor and management that these conditions be discovered. The ophthalmologist working in close co-operation with the medical staff of the plant has this valuable service to perform and has a selling job as well.

In every issue of the *Public Health Reports* of the United States Public Health Service, you will find the phrase "No health department, state or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring." With like reasoning, no plant can effectively prevent or control the problems of industrial ophthalmology without knowledge of when, where, and under what conditions such problems occur.

A beginning in these evaluations is under way by surveys operated and sponsored by the National Society for the Prevention of Blindness, such as job analysis studies in Connecticut under Dr. Lo-Presti where 1,000 employees were examined; the survey of 20 additional plants from the point of view of eye care; the survey of eye conditions in 50 plants discussed by Mr. Tolman at the opening session; the Stevens Institute survey to demonstrate the value of a screening device; and the pioneer survey work of Dr. Hedwig Kuhn. In our program planning we have the backing of the Joint Committee on Industrial Ophthalmology of the American Medical Association, the American Academy of Ophthalmology and Otolaryngology, and the United States Public Health Service.

The United States Public Health Service, through its Industrial Hygiene Division, is prepared to give to industrial plants the benefit of its collected knowledge of industrial health, to advise and assist in making plant surveys with the co-operation of the State divisions of industrial hygiene and community agencies, and to assist in correlation of methods and findings. The Service has recognized the importance of eyesight conservation in industry by the participation of its representative in the survey now being con-

ducted and approves of the seminar now in session for the training of ophthalmologists in industrial medicine.

The field is wide and the demand for these trained professional men will be increasing steadily as management realizes the importance of eyesight conservation in maintaining the efficiency of the worker. The ophthalmologist giving part or whole time to this field of professional endeavor will find an interesting vocation and will make an immeasurable contribution to the war effort and to the reconstructive work that is to follow cessation of hostilities.

References

1. *Chemical and Engineering News*, January 25, 1944, p. 130.
2. Kuhn, Hedwig S., M.D. *Industrial Ophthalmology*, St. Louis: C. V. Mosby, 1944, p. 209.
3. *Ibid.*
4. *Industrial Aspects of Ophthalmology*, p. 231, below.

Responsibility of the Ophthalmologist in the Industrial Field

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IT IS generally acknowledged that the science of medicine and the application of such knowledge for the relief of human ills have made notable and continuous progress. However, despite these facts there still exists a gap between our scientific medical knowledge and its practical application to human needs. Though the quality of our medical practice has been said to be the highest in the world, there is just ground for criticism because of failure to reach all classes in its distribution. The medical profession is now giving careful study to this problem of establishing ways and means by which adequate medical service may be distributed to everyone.

These general observations apply also to the field of ophthalmology. Indeed, they are particularly applicable to that part of this specialty which relates to the vision of industrial employees to which our attention is directed at this time. The field of industrial ophthalmology is broad and complex. Its extent can best be shown by the fact that there are more than 45,000,000 industrial employees in the United States. All these should have at least some kind of pre-employment visual examination. In addition many will require a complete examination, for the purposes of diagnosis of their visual defects, for correction, and for proper job placement. The magnitude of these simple steps is indicated when we consider that there are only 6,000 physicians practicing ophthalmology including 4,000 who practice eye, ear, nose, and throat. This indicates that if we could divide this number of patients equally among all of us, each would have 7,500 industrial patients to examine immediately. The complexity of this field is shown by considering the fact that in addition to the examinations there is the care of eye accidents, institution of programs for their prevention, medico-legal

DISTRIBUTION OF EYE PHYSICIANS AND OPTOMETRISTS IN RELATION TO INDUSTRIAL WORKERS, BY STATES

State	Number of Ophthalmologists*	Workers per Ophthalmologist	Eye, Ear, Nose and Throat Practitioners†	Workers per Practitioner	Number of Optometrists‡	Workers per Optometrist	Industrial Workers
Alabama	7	113,406	67	13,341	140	6,384	893,848
Arizona	5	30,034	21	7,151	37	4,058	150,173
Arkansas	3	194,648	36	16,220	104	5,614	583,944
California	150	16,835	292	8,648	1,432	1,763	2,525,281
Colorado	30	11,658	49	7,137	193	1,812	349,735
Connecticut	34	20,015	56	12,152	245	2,740	680,490
Delaware	2	51,314	11	9,330	30	3,421	102,627
District of Columbia	39	7,921	80	3,861	94	3,286	308,900
Florida	12	56,944	75	9,111	153	4,466	683,333
Georgia	10	110,741	77	14,382	168	6,592	1,107,412
Idaho	4	39,652	18	8,811	67	2,367	158,606
Illinois	127	22,633	322	8,926	1,868	682	2,874,431
Indiana	32	35,991	136	8,469	429	2,684	1,151,703
Iowa	17	50,752	141	6,119	382	2,258	862,781
Kansas	11	53,075	81	7,208	302	1,933	583,826
Kentucky	15	56,505	79	10,728	232	3,653	847,563
Louisiana	22	35,052	58	13,070	195	3,954	771,142
Maine	17	16,413	24	11,627	140	1,993	279,036
Maryland	31	22,287	49	14,100	153	4,430	690,911
Massachusetts	88	17,440	141	10,885	884	1,736	1,534,787
Michigan	54	33,795	186	9,812	706	2,585	1,824,953
Minnesota	28	33,268	121	7,698	425	2,192	931,499
Mississippi	3	242,485	48	15,155	88	8,266	727,455
Missouri	76	17,067	91	14,254	708	1,832	1,297,094
Montana	4	46,391	26	7,137	68	2,729	185,564
Nebraska	16	27,089	55	7,880	230	1,884	433,427

* Certified ophthalmologists.

† As listed in the *Directory* of the American Medical Association.

‡ As listed in the *Directory* of the American Optometric Association.

DISTRIBUTION OF EYE PHYSICIANS AND OPTOMETRISTS IN RELATION TO INDUSTRIAL WORKERS, BY STATES (*Continued*)

State	Number of Ophthalmologists*	Workers per Ophthalmologist	Eye, Ear, Nose and Throat Practitioners†	Workers per Practitioner	Number of Optometrists‡	Workers per Optometrist	Industrial Workers
Nevada	..	..	4	10,116	19	2,182	41,462
New Hampshire	10	17,599	21	8,381	98	1,796	175,999
New Jersey	53	29,605	110	11,264	651	2,410	1,569,059
New Mexico	1	140,269	15	9,351	36	3,896	140,269
New York	412	12,074	259	19,168	1,764	2,820	4,974,518
North Carolina	12	1,007,724	84	14,389	148	8,167	1,208,690
North Dakota	3	66,798	27	7,422	60	3,340	200,396
Ohio	90	26,055	232	10,108	1,114	2,105	2,344,967
Oklahoma	9	73,193	99	6,654	206	3,198	658,739
Oregon	8	48,733	64	6,091	129	3,022	389,798
Pennsylvania	236	13,687	255	12,667	1,578	2,047	3,230,167
Rhode Island	5	52,945	11	24,066	120	2,206	264,723
South Carolina	2	330,536	42	15,740	88	7,512	661,073
South Dakota	2	102,257	17	12,030	80	2,556	204,514
Tennessee	14	67,265	77	12,230	218	4,323	941,714
Texas	47	45,496	260	8,224	651	3,285	2,138,355
Utah	7	21,269	31	4,803	58	2,564	148,886
Vermont	1	125,092	18	6,950	167	748	125,092
Virginia	23	40,567	88	10,692	157	5,943	933,058
Washington	21	28,936	92	6,604	239	2,543	607,672
West Virginia	9	57,677	66	7,865	106	4,897	519,094
Wisconsin	15	70,717	145	7,316	432	2,455	1,060,758
Wyoming	2	43,279	5	17,312	26	3,329	86,559
Total	1,819	..	4,363	..	17,618	..	45,168,588 Working population in U. S.

* Certified ophthalmologists.

† As listed in the *Directory* of the American Medical Association.

‡ As listed in the *Directory* of the American Optometric Association.

service, the consideration of all matters relating to the conservation of the vision and of rehabilitation of the injured. Such a complete service by ophthalmologists is physically impossible and it is not practicable or necessary, as satisfactory preliminary or screening tests can be made by instructed or trained personnel which will eliminate those who have standard vision.

Many surveys have been made which indicate that on the average about twenty per cent of industrial employees have defects of vision sufficient to be a handicap to efficient production. These can be screened out using some practicable method of screening by laymen. This method will make it unnecessary for the ophthalmologist to examine the 80 per cent having standard vision. If one third of all ophthalmologists were practicing ophthalmology and these should care for the defective 20 per cent, each ophthalmologist would still have 4,500 industrial patients to care for. Compensible eye accidents alone are 300,000 per year. These observations and data indicate the scope of visual service which industry requires. And despite the extent of this field and its complexities, in accord with the best medical traditions and principles of the ethics of the medical profession, the responsibility for rendering adequate ophthalmic service to industrial employees should be assumed and all difficulties should be overcome.

In the past, the field of industrial ophthalmology has been neglected, but the needs in this field have been given serious consideration recently, and progress is being made in the development of a better service. It might be profitable to point out briefly some of the underlying causes for this neglect.

First: As pointed out above, one of the causes is the lack of sufficient ophthalmologists, but many could give more service in this field than they now give.

Second: The neglect has an economic phase in which employers, employees and ophthalmologists are concerned. From the economic point of view, each of these groups has generally assumed the following attitude: (a) Employers have not been willing to assume all the cost incident to pay for loss of time which is necessary for making eye examinations at the office of the ophthalmologist, nor for the cost of many ophthalmic supplies, such as goggles and corrective lenses and their mountings. In many plants the cost of

establishing and maintaining a medical staff or even a first aid service has been considered prohibitive. (b) Employees have not been able to bear the expense of proper care of their eyes. (c) Ophthalmologists have not assumed their share of the problem of finding ways and means for bringing their services within the economic sphere of both employers and employees. Such problems demand our very careful attention. Points of view of all relating to cost and to methods must be adjusted by compromise.

Third: Ignorance on the part of many employers of the importance of good vision in productive efficiency, in prevention of both eye and other bodily accidents, in the maintenance of good health both ocular and general, and of the value of good vision on the contentment and happiness of employees. Employees also often are not aware of their visual defects and of the possibility of their correction. The ophthalmologist has not yet learned the most practical method of giving the most useful service to industry or what constitutes adequate service to industrial employees.

Fourth: There is some indifference on the part of all three interested groups. Industry is often not sufficiently interested in the visual welfare of its employees; employees often have an indifferent attitude towards proper or adequate care of their eyes; and ophthalmologists are often indifferent to the visual problems of industry and its employees. There is a tendency on their part to cling to old and conservative methods of practice, and an unwillingness to meet the reasonable demands for change in methods of practice. Although there could be much saving of time of the employee if the ophthalmologist would make provision for rendering ophthalmic service at the plant, he still wishes to confine his practice to his office. Educational programs which are suitable to each of these groups would overcome some of this indifference.

From a consideration of some of the fundamental causes which underlie an inadequate ophthalmic service in the industrial field, as mentioned above, it is evident that the establishment of a more adequate service will require the co-operation of all three groups who are interested in and responsible for such service. But in introducing this seminar the attention of the ophthalmologist only is directed to an outline of some of the phases of industrial ophthalmology; and his attention is called also to his obligation and

responsibility for a more adequate service to meet the demonstrated needs in this field.

Visual conditions as they exist in industry today have been surveyed in a number of different types of plants and these make a good cross section pattern of such conditions in the country as a whole. Many of the pertinent facts of a recent survey will be presented by Mr. Tolman. Other surveys have been made by Drs. Tiffin, Kuhn, and others. From all of these data the ophthalmologist is able definitely to understand the needs for a practical and adequate ophthalmic service in industry. From this data, we find that the treatment of eye accidents is of high grade, that the protective program, especially the use of goggles, is excellent in most plants, but there is still room for improvement. This program could be improved by more careful fitting to the individual and by using those types most suitable for the specific jobs. Correction of refractive defects is largely neglected. First aid, largely by the employment of trained nurses, has been greatly extended during the past few years in the larger plants; but the smaller ones are still neglected. In most of these smaller plants all phases of ophthalmic services are lacking.

By way of introduction to those present in this seminar, and in order to outline the scope of desired activities in the industrial field, let me list some of the aspects of practice in which the ophthalmologist should have special knowledge or interest, and in which he should participate. But first, let me state parenthetically that every industrial ophthalmologist should make it his duty personally to visit and inspect the visual demands of any and every plant with which he has any association. Very much more can be learned of the visual task in this way than by merely getting a history of any industrial operation. Some items in the following listing have been indicated above but may be repeated for sequence of ideas. This list of desirable fields of activity follows:

1. Aid in the establishment of a medical staff. An ophthalmologist should be included—full time, part time or as consultant.
2. Establishment of a system, or method of testing the vision of pre-employment applicants and of all employees. The latter is best accomplished by some approved screening method. Provision should be made for rechecks at stated intervals.

3. The development of suitable records. These should contain all data obtained from the individual's history and from all tests and examinations. These tests should contain data which will aid in the proper placement of all potential or present employees.
4. The establishment of suitable programs for examining those found to have subnormal vision, for correction of these when possible, and for furnishing the indicated supplies.
5. Institution of protective programs and methods for their continued application.
6. Establishment of first-aid stations. This requires special equipment for examination and for treatment of eye injuries. A nurse specially instructed or trained is most suitable and her services are most valuable. All activities of the nurse should be under the direction of an ophthalmologist.
7. The study of adequate illumination.
8. The study of occupational lenses. The demands made on vision by modern industry vary greatly with various types of employment, so that the industrial ophthalmologist must consider more than securing the best visual acuity at 20 feet or at 14 inches. Some types of employment require good vision within the usual 14 inches. Still others require good vision at these and all intermediate points.
9. Assistance in placement. Visual ability or skill is not possessed at a maximum degree by all employees, even with the best correcting devices. Therefore, the ophthalmologist should indicate to the placement personnel, those jobs which are suitable to the best obtainable vision of each employee, keeping in mind efficiency and the risk of injury to his other organs or to other persons. This implies a huge task of job classification.
10. Consideration of all the special problems connected with any specific employment. In some occupations color vision is essential; in others skill in color discrimination is required; and in others good stereopsis (depth perception) is necessary.
11. Study of problems of the relation of vision to general health and vice versa. These may include problems of ventilation, of posture, of nutrition, and of domestic and social relations.
12. Rehabilitation of those sustaining eye injuries by finding suitable jobs for these after proper training.
13. Giving aid to problems relating to vision in the medico-legal field which requires expert knowledge of the compensation laws of the several states, and the computation of the degree of visual disability resulting from injury.

In general, the industrial ophthalmologist, in addition to his specific fields of activity, must consult and co-operate with management, placement personnel and medical staff members on many problems which may arise in any plant. And finally, in order to meet the needs of industry and to close the gap in a neglected field of ophthalmology, the industrial ophthalmologist must understand the best methods by which he can serve the visual needs of industrial employees, and he must assume the responsibility for rendering the complete and adequate ophthalmic service both to industry and to industrial employees.

Industrial Aspects of Ophthalmology

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THE Seminar on industrial aspects of ophthalmology now in session in New York City has as its worthy objective, the arousing of interest of ophthalmologists in the eye problems in industry, emphasizing: (1) a need for an adequate eye conservation program, (2) the lack of a sufficient number of industrial ophthalmologists to carry out such a program, and (3) the necessity for increased instruction in industrial ophthalmology in medical schools.

The need for an eye conservation program in industry has increased with the demand for more and more workers and also with the utilization of handicapped persons formerly rejected as unfit or undesirable in industrial jobs. Potential employees with correctable eye conditions, or with defects that should not disqualify them for certain jobs, were formerly ruthlessly refused industrial work—partly because of compensation costs that might result. Today with a demand for every available worker, it is the problem of industrial ophthalmology to select the jobs suitable to the visual ability of workers, in order that they may contribute to the war effort. Above all, it is the responsibility of the industrial ophthalmologist to conserve the eyesight of every employed person.

To what degree spoilage of materials, industrial accidents and absenteeism, due to eyestrain or eye diseases, may be lessened, can be determined best by the industrial ophthalmologist. Correction by proper lenses, muscle exercises and other devices, is but a part of the problem. Both analysis of the job to determine the visual requirements of the employee, and corrective measures to give a visual acuity as nearly normal as possible, have been neglected factors in most industries. Eye hazards in industry, on the other hand, have had proper consideration and extensive thought has been given to the use of protective goggles. However, according to a survey of the National Society for the Prevention of Blindness, it

was found that in 50 plants employing a total of over 165,000 workers, only 70 per cent of the plants fitted goggles to the workers, and, moreover, the wearing of these devices was not generally enforced. Even in so-called non-hazardous jobs, the fact that so many goggles are broken, indicates a need for their constant use. Enforcing the rule to wear goggles is the responsibility of plant officials; educating workers to appreciate their value can well be the function of the ophthalmologist.

In addition to job analyses to fit workers into jobs adapted to their visual ability, to the prescribing of proper lenses, and to treatment of eyes after industrial trauma, an industrial eyesight program must include diagnosis of general diseases with eye manifestations. These diseases include cardiovascular disorders, blood dyscrasias, brain tumors, syphilis of the nervous system and various other conditions that affect the blood vessels of the eye. Specific diseases of the eye such as trachoma, glaucoma, iritis and many other pathologic conditions should be diagnosed in pre-placement examinations or in periodic re-examinations.

The results of a survey to determine the status of eye conservation practices in industrial plants, conducted in 1942, have indicated the acute need for ophthalmologic services in industry. Although 98 per cent of the plants surveyed have safety programs, with 90 per cent having safety education of employees and 90 per cent medical supervision, only 24 per cent have job analysis with industrial visual requirements, and only 20 per cent have visual examination of the eye made with binocular instruments. In reporting of accidents, only 22 per cent of the plants included eye tests of those involved and 12 per cent considered the possibility of illumination as a contributing factor. These figures indicate the indifference shown in industry to eye conditions.

The need for ophthalmologic service in industry, therefore, is seemingly as great as is the acknowledged need for medical, dental and nursing service. The Industrial Hygiene Division of the U. S. Public Health Service has recognized this requirement in a well-rounded program for industrial hygiene. One of its medical officers, who is a specialist in this field, has been assigned to the headquarters of the National Society for the Prevention of Blindness to assist in the development and conduct of a program in eyesight

protection in industry. This is but a step in further development of co-ordination of industrial ophthalmologic service with other hygiene services now functioning in industry.

The general industrial hygiene program is directed toward decrease of illness and injuries, and the improvement of the health and efficiency of all personnel with a consequent decrease in costs to the worker and employer. If 60,000 compensable and 240,000 non-compensable industrial eye accidents occur annually in the United States, certainly conservation of eyesight must be a considerable part of this program and particularly if, as it is claimed, these accidents occur chiefly in foundry, machine tool and metal industries, all of which are vital to the war effort.

With the development of a program for eye conservation in industry comes the further problem of securing a personnel especially trained for this work. Not only has the number of available ophthalmologists been depleted by calls to the Armed Forces, but those in private practice, with few exceptions, have little knowledge of eye conditions in industry except as they have attended workers in their own offices. The relation of eye lesions to industry is not generally understood nor are the adaptations that may be made to continue the worker in his job. Use of the Snellen chart in the measurement of visual acuity is only one step in the eye examination of an industrial worker. Depth perception, muscle balance, color deficiency, all must be evaluated in determining the worker's ability to do a given job effectively and without injury to himself, to others and to the materials with which he works. He must understand not only the evaluation of normal and abnormal vision in industry, but the methods for conservation of eyesight in addition to prevention and treatment of eye traumas. He should be acquainted with industrial environmental conditions—illumination, toxic chemicals and gases; he should know something of compensation laws as related to injuries to the eye.

Industrial ophthalmologists have a greater responsibility than the removal of foreign bodies from the eye or repair to injured eyes and eyelids. They must confer frequently with management and other officials, with safety engineers and with the medical department. There must be close co-operation with the medical service in diagnosis and treatment of various eye conditions related to

systemic diseases. It is the function of ophthalmologists to establish eye standards in industry and to assist in the rehabilitation of those with injured or otherwise defective eyesight.

By no means does all this imply that full-time ophthalmologic service or complete ophthalmologic equipment is required in industry, except possibly in very large plants. Part-time service in conjunction with that offered by physicians and nurses in the plants usually will suffice. Yet even with only part-time service, the supply of industrially trained men will be insufficient. Ophthalmologists now in private practice may obtain practical information by attending seminars such as you are attending tonight. Medical schools should give greater emphasis to the teaching of industrial ophthalmology. Medical students may well prepare themselves for a career in this industrial field, now in its infancy, perhaps, but in war or peace, a constantly broadening one as its potential services are realized.

The U. S. Public Health Service, through its Industrial Hygiene Division, stands ready to assist in the preparation of eye conservation programs, to give consultant service through its ophthalmologists, its physicians and its engineers, and to further co-ordination of ophthalmological service in the nationwide industrial hygiene program.

Visual Job Analysis and Prescribing for Special Work Distances

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IN order properly to refract and prescribe for an individual operating any kind of machinery, it is essential to become thoroughly acquainted with the specific mechanics involved. If one's relationship is that of ophthalmological consultant to an industry or industries, it is highly recommended that a careful visual job analysis of the entire plant be made, using a work sheet.* The operations, job numbers, and departments can be entered on those sheets prior to going through the plant; and it is well to go through with someone thoroughly familiar with all operations. By use of a check on this analysis chart (which of course can be revised or changed to suit individuals or special needs) it is possible to note, as inspection is being made, the most important items. Details can be filled in afterward.

Any one of several visual functions may be important on a given job. If so, each one should be checked. Important among these are the following: (1) Distance acuity; (2) near acuity; (3) distance muscle balance; (4) near muscle balance; (5) color; (6) stereopsis; (7) multiple work distances; (8) illumination; (9) work in motion or not; (10) hazards if any, such as glare, foreign bodies, fumes, flash, etc.; (11) are bifocals permissible or not? and (12) what degree of perfection is required—perfect, fair or poor?

In addition to checking these factors and others of particular interest, it is important to make marginal notes of anything that strikes the inspector at the moment. With this sheet, he can then sit down and thoroughly acquaint himself with every job and its name. Whether a refractionist is placed in that plant or these people are refracted for industry in the doctor's private office or they are refracted as private patients, the inspecting doctor has

* See page 236.

SAMPLE CHART
VISUAL JOB ANALYSIS

COMPANY NAME _____ DATE.....

CODE ✓ = Important
✓ ✓ = Essential

DEPT.	OPERATION	JOB	Distance Acuity	Near Acuity	Dist. Muscle Bal.	Near Muscle Bal.	Color	Stereopsis	Class A—Perfect	Class B—Average	Class C—Def., OK	Bifocals, OK	Bifocals, Bad	Illumination	Tint Advisable	Work in Motion	Glare Factor	F.B. Hazard	Fume Hazard	Splash Hazard	Infra-red Hazard	Ultra-violet Hazard	Work Dist. Multiple	Etc.
27	Drill Press	70	✓		✓					✓				✓				✓					✓	
14	Spot Welder	24	✓			✓				✓					✓		✓ ✓				✓ ✓	✓ ✓		
16	Inspector	14	✓	✓ ✓	✓	✓ ✓			✓			✓		✓										
60	Labor	39	✓								✓													
18	Crane Operator	24	✓		✓			✓	✓					✓									✓	

acquired a thorough understanding of their work and the demands made on their eyes.

To illustrate various types of industrial operations—a gantry crane operator in the shipyards, absolutely must have excellence of distance acuity and depth perception and normal distance muscle balance. The operator of a strip mill has entirely different things to do with his eyes. Here distance acuity is of great importance. There are gauges and dials placed at all levels, high over the operator's head, on the level with his eyes, and below eye level. When things work smoothly and normally, such a man is not in any difficulties as far as his eyes go. However, bifocals might definitely interfere with operators who need to act quickly in an emergency. I have seen this happen. Inspection of tin plate which has reflections and glare from the polished surfaces, requires excellence of *near* vision acuity and near muscle balance. An individual who reads a micrometer does so usually, only at intervals, during the day. Because figures of the scale are exceedingly fine and are usually read at eight or ten inches, the add required is entirely different from that ordered for the same individual in order to read a newspaper at the regulation reading distance of 14 to 16 inches. Each such case has to be determined on its own merits. In the corrected vision goggle, a solution has been offered in what is called a "flip up" goggle. Here the add is put separately in a little hinged attachment and brought down into position only when it is necessary. This leaves the distance a single vision lens for such operations as turret lathe, etc.

In general, inspecting of any type is one of the major and most difficult of industrial visual problems. For instance, bottles may approach an inspector on a conveyor belt moving from left to right. They are inspected through a large magnifying glass. The element of glare from a light which is often directed into the operator's eyes, the constant motion from left to right, the distractions which are usually not shielded from the operator—such as the moving belt—make for great fatigue. These girls inspect for 15 minutes or so only, at intervals throughout the day. They look for 14 or 15 defects in each bottle, and inspect as many as 80 per minute; so you can see what the visual problem is. The lathe operator has multiple work distances in the handling of his complicated ma-

chines. Many require precision setting and close watching. Wearing bifocals in some of these lathe operations can be a great handicap, although many operators do wear them with comfort.

An electrician needs both visual acuity and color appreciation—different wires being followed through an installation, on the basis of color. An electric truck operator, working inside of a plant, obviously needs good distance acuity and depth perception in order to guide a fast-moving vehicle through narrow lanes, as well as for picking up a load. In the inspection of gears of highly polished steel, excellence of near vision is essential. Present here, also, are the problems of glare and proper lighting. In a few cases, it may be advisable to use a tint in the lens, as, for instance, in the case of an especially light-sensitive person. It is not advisable, however, to use a tint for all inspectors of highly polished metal or for all people in any given department. Such general and indiscriminate use makes workers feel that there may be a hazard which is not actually present.

Fingerprint classifiers use a magnifying lens in one eye. Obviously, any type of ordinary glass correction would bear no relationship to this type of visual job. It will be possible some day to give these people binocular magnification of sufficient strength to do their work, without the strain imposed in doing it according to present methods. People reading blueprints have need of good near vision and of normal near muscle balance. The figures and lines are very small, blueprints are often tacked to a table, so that some of the distances are 14 inches, some 24, and some even 30 inches. Trifocals may be of assistance in this type of problem.

Small-parts assembly requires excellence of all near vision functions, and often also of color. In most instances, such work could be done with a much higher degree of comfort if special occupational glasses were prescribed. These would be left at the machine at the end of a work day. Here we may need to consider also, the height of an individual, whether or not chairs or stools are fixed, and what the illumination is, before prescribing. Overhead inspection, such as at the roof of a mine, brings up a new problem. Occasionally an upside down bifocal is helpful here. Illustrations were shown simplifying these statements, which it would be repetitious to discuss here.

Now I want to give you at least the general background of industrial defects, if I may, so that we have them in mind when we think in terms of refracting for a work distance.

The correction of visual defects of industrial employees is the number one assignment that ophthalmologists have. You already have been given the statistics of such defects, but we still must keep them in mind. There are five basic categories that we use: (1) *unaided acuity* (distance acuity without correction); (2) *working acuity* (which is the acuity of an individual with whatever glasses he is wearing, which may not be the best); (3) *muscle balance;* (4) *depth perception;* and (5) *color perception.*

Substandard visual performance, as shown in graph form, in ten industries, gives one an almost universal 15 per cent defects of acuity that do require attention. Visual defects among applicants in industry are close to the same percentage as that shown for those already in industry. This pretty well explodes the theory that industry produces visual defects through strain, or other causes.

The biggest stumbling block to the whole industrial program has been the question of keeping well-intentioned people from trying to correct almost everything. This is now done in the schools, where it has more merit, and where anything suspicious is best investigated.

If, in industry, you become so discriminating that you send out or advise to go out for correction, all people with defects of 20/30 vision, 20/40 vision, even 20/50 vision, per se, you may well flood the district with people seeking advice. In a highly industrialized area this can become a very awkward and topheavy procedure whereby you lose the punch, and risk the effectiveness of the whole program. Actually, when you boil it down, about 15 per cent are serious eye defects of one kind or another—that is, vision 20/100 or less in one eye, a squint, or a pathological condition. For color blindness, of course, there is no remedy, in spite of the cults advertising such cures. We have a big problem as it is, with the 15 per cent needing attention. In one plant of 10,000 employees, this meant 1,500 people whom the medical director had to interview himself. A man with a serious eye condition has the right to be seen by the plant medical department and to be told how to take care of it. Industry has become soured in many instances where

it was advised that everything should be corrected, little and big.

Undoubtedly we shall miss some serious eye defects among the screen tested "normals." We should like to do field of vision tests and fundus examinations on everyone; that is impossible now, but maybe after the war we can. We shall therefore for the present overlook some glaucomas, early brain tumors, optic atrophies, and retinal hemorrhages. But we certainly do accomplish a great deal by being practical—we do find and care for most of the serious eye trouble.

There is a marked difference between the percentages of eye defects as of 1940 and of 1943 among both payroll employees and applicants. The defects in both groups are much higher now, and we see clearly what our eye problem, from the standpoint of pathology and correction, has come to be. Among the applicants the rise is even more obvious than among those on the payroll of industry, because we are now practically "scraping the bottom of the barrel."

Percentages of visual defects vary in different types of occupation. In nature, the survival of the fittest has assisted in a sort of job placement program. One cannot be a crane operator and stick to that job unless one has the basic visual skills to do it. One may have an accident and be taken off, or one may not do one's work well enough, and be taken off. A foreman has to do a little bit of everything, therefore is shown to have a high record of all visual skills because he has *had* to be highly qualified to survive.

Statistically, we found the visual standards that we set for applicants for these jobs match closely those shown by nature's choice. Nature has thus supplied us with what the industrial psychologists and statisticians are now giving us as "predicted" performance.

It is important to say a few things about illumination at this point. We give a person glasses in order to make him see more clearly as far as his refractive error goes, but he does also have to have light. We need to know a little bit what the illuminating engineer can do to assist us. A welder is supposed to do an accurate job. But he does not have the light to inspect what he has done after the "flash" of his arc is off—then it is dark! This all has a

direct bearing on the ophthalmologist's understanding. It is one thing to refract a man so he sees with illumination, and it is something else to refract him for a prescription welder's goggle if he hasn't got the illumination. The complaint still comes to *us* so that we have to *know* in order to tell him why his glasses don't work. You have probably all read Luckiesh's article in which he talks about knowing something about what the degree of vision is *at the place of work*. In other words, we have standards of illumination for testing vision, with fixed number of foot-candles for a Snellen chart. That gives us our standardized medical-legal record.

We still need to know what that person's visual acuity is at his particular job. Believe me, it is very often very different. It does not follow that he has normal acuity at that job because he had it in your examining room. Unless we follow through and are able to suggest that he be supplied with the illumination in critical jobs, we have really undertaken only half of our responsibilities. Nor do we encroach on anyone else's territory—we are informed.

Great numbers of "flash" cases are due to the fact that a man *has* to take off his *goggles* (his hood is already off) in order to see what he has done, because at that moment the fellow next to him "strikes" an arc, and the unprotected man gets the "flash."

I want to tell one little story which drives home the importance of the private office as a source of proper or improper refracting for industry.

> Mr. and Mrs. John Doe have been our patients for a long time. Mr. Doe is a foreman in an industry, and we have prescribed glasses for him and his job long ago. Mrs. Doe has always been just Mrs. Doe, but now she also has a clock number. She is an inspector in a nearby plant. She has previously never been very co-operative about wearing her glasses, but it did not matter so much, actually. Now she is a brand-new type of patient. While she is still a private patient, her eyes, which were used for reading and sewing and playing bridge, are now used for sustained near work eight to ten hours a day. Mary, the daughter, came in because she had some difficulty passing the company eye test. She wanted to work in a plant and she couldn't read more than 20/100. She is very nearsighted. Her prescription will not be the same as you would put on her if she were just going to school and parties.

(Here the question of exact work distance is vitally important, as I will show a little later.) The same holds true for son George, who is highly astigmatic. He has never properly worn his glasses. Now he is in real trouble, even with his glasses on.

So you see that actually you don't have to go out to meet industry. Industry comes to you in just such problems as these, in which a whole family now have clock numbers and are workers and not drones.

The question of age in industry has added other entirely new problems of vision testing in industry. In comparison of visual performance in people over and under 40 years of age, we again see the tremendous increase in percentages of visual defects, this time in the mature age group. This is particularly true, of course, for near vision, and muscle balance. Incidence of muscle imbalances become much higher in people over 40 than under, especially if they are indiscriminately refracted and exophorias are created!

Professor Greenly, one of the great industrial psychologists, said, in a communication, that "it is worth while and necessary to survey our visual problems and to evaluate them, but it is even more important and appropriate these days to work out some kind of visual improvement, and with older workers the needs for such a comprehensive visual program have been very greatly heightened."

In our personal life we have an opportunity to vary what we do. If a housewife gets tired of reading, she can go shopping, or make a cake, or play cards; constantly, all day long, the work distances and play distances are varied. When we go into industry we have to do our job, which may be a single concentrated effort, and carry it on for eight consecutive hours. There is often need for constant, focused visual application; if the employee is unable to do this, he is out of luck and so is industry.

Working distances for exacting jobs are variable and the side effects are multiple. For instance, bench workers are people whose work is quite close and exacting, such as grinding or assembling small parts. The urgent need for seeing reflects itself in their posture. In one of our plants the bench workers and the precision workers were found to be sitting in every conceivable position. Some were up on top of their work, some were back and away from it; some had it in their laps, while others held it out in front of

them. They had their personal glasses on. As soon as these were changed and each worker was corrected for his work distance, these same people assumed natural and relaxed postures. The resulting comfort from having the glasses adjusted to work distances reduces absenteeism as well as irritability.

In a plant that makes gas masks, 200 operators were using sewing machines. There was a conglomeration of every shape and size of human being imaginable, each with a fixed work distance, in so far as chairs and furniture went. Here would be a tall woman, and she was bent down to her work; next would be a short woman leaning back from her work; here was one with her head at an unnatural angle. The first-aid station of this department was filled with women complaining of headaches, and the rate of absenteeism was up. As soon as the occupational lens distances were worked out, all of this disappeared. The same is true of workers on the small parts assembly, and of loopers.

When we speak of an "occupational" correction, what do we actually mean? We mean that we are attempting to restore the normal visual relationships which are disturbed by abnormal work distances. In other words, in our everyday life we usually work at 14, 16, or 18 inches for close work, while in industry it is often necessary to work at eight inches—for some operations at even six. That produces abnormal mechanical relationships of size of object and extra-ocular muscle effort. Therefore, what we do in ordering occupational correction is to attempt, by magnification and prisms, to correct to normal relationships of seeing. By the way, it is important never to imply, when conferring with management of such an industry, that the work a girl is doing at six inches is harmful to her eyes, and that we think she should get glasses to *protect* herself. This is not true. As soon as one implies an injury, one has created a hurdle for oneself in the psychological handling of management and labor. What we actually do is to suggest that she wear special occupational lenses, which, being really an optical aid (like a microscope) restores the normal physical relationships.

Nor does the worker have to be over 40 to have special near vision jobs. This we all know. One can be hyperoptic or astigmatic, and have a near vision difficulty at any age. Workers etch at six inches while others draft at 30. Also, we must take into consid-

eration all of the physical movements of the person for whom we prescribe. Does he climb on high scaffolding? If he does, do not give him a bifocal! Does he have to watch fast-moving steel in order to pick up defects as it *moves?* Is his inspection at eye level or above? Does he have a combination of work distances? On a line of ten lathe operators not every operator may need to do the same thing. Two may use a micrometer at intervals during the day—the other eight may not. If a lathe operator never uses a micrometer, and his machine is entirely automatic, with no need to test or inspect anything, do not prescribe bifocals for that operator. Giving these people the proper prescription depends on knowing all the factors of the job.

It is important to know when prescribing, whether there is excessive glare and whether it will need to be corrected by using a tinted lens. It is important to know whether the person is short or tall in relation to his machine. In fact, for some of the critical jobs we may need to go out to the plant, find the person and be sure all is well for him as an individual, at a specific machine. A different amount of plus often is needed for an eight- to 12-inch distance, than for a 14- or 18-inch distance. But if just plus is prescribed and then we sit back and say, "Now he can see," we get our patient and ourselves into real difficulty. We must make phoria measurements, to know whether that person has an exophoria to start with. He may not have a phoria for his usual reading distance, but the same man may have a marked phoria at the lesser distance of eight inches. Among 200 loopers in one plant, working at eight inches, 60 per cent of the girls had normal phorias at 14 to 16 inches. But of those who did have normal phoria measurements at 14 to 18 inches, 40 per cent jumped to an exophoria varying from 24 to 30 degrees at eight inches work distance! If someone needs plenty of plus to see, he may require a prism (base-in) and he may also need training—orthoptics. In the presbyope you have the same sort of thing, except that the range is more fixed because the lens has no elasticity.

Refracting and prescribing for the myope must also take working distance into consideration. Here I shall tell you an interesting story that illustrates this whole picture.

A textile plant employing loopers had a very excellent ophthalmologist. Management, knowing there was an eye prob-

lem, sent all their girls over to him for refraction. He refracted them in his office. Many of them were kids—16, 17, 18 years old. Many were myopes and had never before worn any glasses. He took their Snellen chart readings, and refracted them, prescribed their *full* myopic correction and told them never to take their glasses off. You can imagine the rest! Attempting to operate at an eight-inch work distance with their full minus correction threw them and industry into a real tailspin. It was only because this ophthalmologist had never been inside the plant, and had no idea what the girls' work problem was, that this happened. Instead of assisting either the girls or industry, he did them a disservice and pretty nearly upset the whole program.

There are many myopes, who have never worn a prescription, who are difficult to prescribe for unless we know pretty much what their job is. May I here indicate my strong personal aversion to prescribing bifocals for young myopes—it is never necessary.

The question of correcting astigmatic errors for people working in industry is one in which I think most of us get our gray hair. We have to remember not the textbook, not the theory, but *the job* and the hours and the fact that humans are cogs in a "must" production effort. If a man has never worn corrective glasses, has normal vision, and is doing drill press work or something that does not have to be ultra-exact, we may be able to put on a full astigmatic correction. But we are going to have trouble with some jobs and we cannot help making a few mistakes in order to get the "feel" of each particular job before ordering a specific correction. If a man is young and able to adapt himself, it is worth attempting full correction and telling him in advance that if he has too much trouble, his prescription may need to be changed. But we must remember that when you prescribe a change of axis or a full new astigmatic correction for a man who works ten hours a day, six days a week, he has little time to "break in" his glasses. In cases where he has been wearing a wrong axis, has normal vision, and is on a blueprint job, for instance, a change in axis may throw him entirely off. The blueprint lines are different, they slant, and are distorted, as we all know. Ordinarily, this man could take the hurdle and adapt himself to the change, but he often cannot with the pressure of management and the production committees behind him, to turn out work, turn out work, turn out work! One has to

be very, very practical in making such changes. If such a man has normal vision and is doing the job well, don't change his axis just because you know it is theoretically wrong. Maybe later it can be done. But if his vision can be improved from 20/40 to 20/20, one has to take a chance and hope that he can make the necessary adjustment. It is important to identify and institute a follow-up system for these cases, as you will find them prominent among your "grief and trouble" cases (as we call them). These, if any, are the cases we need to go out and find in the plant in order to try to iron out their troubles.

Also, there are people who have great refractive differences between their eyes. One eye has a vision of 20/20, and the other 20/200. Glasses have never previously been worn. If, for instance, we immediately prescribe a minus 3.50 in the one eye and no correction in the other eye, we have created an element of distortion. Few individuals can "take it." They won't wear their glasses, and they will have plenty of trouble and make plenty of complaints. A whole plant program may be jeopardized by our being a stickler to academic procedures. Instead, such a person can be left uncorrected and put in a monocular job—at least "for the duration."

When we discuss bifocals, we enter another complicated phase—often industry would rather have people who have lost a leg than somebody who is *visually* not qualified to work or who must wear bifocals. Bifocal cases are not only a literal headache to themselves but are often a headache to the ophthalmologist. They present also our greatest challenge! The practice "compromise" lenses are very bad. To me it has always been an indication that a lazy refractionist does not want to bother teaching a person how to use a bifocal, does not want to have him come back for adjustments and attention, and, to avoid these, prescribes an in-between glass—a little too strong for distance and a little too weak for close use. About ten per cent of the workers in one plant had compromise lenses, and these are the people that are really in trouble and caused us trouble. They claimed they were perfectly comfortable with what they were wearing. Their glasses were to them like an old shoe. Actually they could not see anything properly. Why not conscientiously attack the bifocal problem, assist people in learning how to use them, and make sure that they have the proper type of bifocal.

The need for concentrated effort, and the long working hours, add to our difficulties. Actually there are some *really* old people in industry these days! For instance, I saw many white-haired ladies making radar equipment. Unusually complicated near work is often a problem for which there simply may be no solution except to change jobs. This is where job placement enters, and where the proper evaluation of industrial visual skills prevents such difficulties.

The mechanics of a bifocal is also something that most of us have not paid enough attention to. We have left too much to the optician at our elbow. In industry we must be able to tell management, "This man should have a Kryptoc, and this one an Ultex." Inspectors usually do well with a pretty generous Ultex segment, as it allows plenty of room and prevents an aching neck. Other jobs do better with a Kryptoc. We need to know something about taking interpupillary distance, so as to emphasize its importance later in dispensing. We need to know what proper decentering is and its importance. We need to know about the "upside-down" segment, and how valuable it can be in cases where there are high dial readings or overhead work. Even nose and throat doctors must use an "upside-down" segment for their occupational correction! We need to know something about frame measurements and adjustments. Very few of the optical people themselves that go into the industries and dispense prescription goggles (especially bifocals) really know how to adjust a frame, or to tilt it so the wearer does not look under his goggles, thereby getting all the rim distortions of a heavy lens. Here is one place where I find the optometrists are far ahead of us; they usually do know how to do these things and do them expertly.

The flip-up goggle has been a solution to some of the headaches of bifocals. A man who has to read a micrometer, but only two or three times during the whole day, has multiple work distances the rest of the time. By putting the necessary plus in the flip-up, he can, when he needs to read the micrometer, just drop it and lock it. Then when he is through and wants to go on with his lathe work he just touches the little spring on the side and it flips up out of the way. The same thing can be done with a tint for heat treatment work, as it is only a few times during the day that a man actually "pulls" a heat. The worker may want a tint for this, and then only,

so for the rest of the day the tint would interfere. The tint then can be put in the flip-up.

The use of all-plastic frames for bifocals is a practice of which I personally am becoming increasingly critical. We have a shop in our own clinic, and our boys are not permitted to dispense bifocals in plastic frames without the doctor's approval. If a person has already worn a plastic frame with comfort, we sometimes make an exception. But if one has to make adjustments (raise or lower or tilt) one is stuck—one cannot adjust a plastic frame! Often people ask for this kind because they are supposed to be comfortable; the frame may be, the lenses and seeing are often not.

When not to order a bifocal is as important as when to order one, of course. Early in developing an eye program with management, we must make the decision that a crane operator is not to wear a bifocal. Stick to that decision, and do not let management talk you out of something that you know is right. Also, do not lay down rules unless, and until, you are sure of what you want. The same is true for electric truck operators, who tell you they have to read orders. If they have to read orders and need an add, they too can use the flip-up or clip-ons. Bifocals and an electric truck going at the usual speed down the narrow and dangerous aisles of the big plant is not a good mixture. The sweepers in one plant raised a fuss because they were not given bifocal lenses in their new goggles. They could not read their newspaper at lunch hours! Management simply told them they were not buying prescription goggles for them to read their newspapers. This differentiation between the use of an occupational correction and a personal correction needs constantly to be emphasized.

My good friend, Harry Guilbert, who has done so much for goggles safety in this country, let the "cat out of the bag" on one thing, when he said, "our goggles are so comfortable that the men wear them home and use them all the time." Perhaps, before industry began to get so many presbyopes, people over 40, this could be proper sometimes. Such a practice now actually means just copying the personal prescription. Sure, they can read the newspapers with this, but who knows whether they see their work? The fact that they *are* using the same prescription for everything is the very thing we are trying to get away from.

The proper use of near-point data is something that ophthalmologists have too often overlooked—they have overlooked it in private practice and in private refracting, and they are overlooking it in industry. Here it is even more important now than ever. The near point of convergence (n.p.c.) and the near point of accommodation (n.p.a.), the degree of exophoria, the amount of ductions, all are essential measurements. Inquiry into whether the person has a low hemoglobin or low blood pressure or toxic foci, is important. There is a close relationship between muscle imbalances and any one or all of these depleting factors. We had noted this very vividly in our office, where we do considerable adult orthoptics. Our cases always responded more successfully if we were sure at the start that they have normal hemoglobin, normal blood pressure, and no toxic factors to handicap them. Occupational orthoptics, as we have called it, is just as much in order as a corrective procedure as is the prescribing of glasses, for certain jobs. Squad car drivers in Illinois are required to have a so-called 100 per cent depth perception. Of course, there is no such thing as percentage of stereopsis—the whole scale of percentages is a false concept—but applicants are told they must have 100 per cent, and find that a printed regulation! So when they come in with a so-called 80 per cent stereopsis, they can be trained, through orthoptic procedures and, usually, brought up to the necessary 100 per cent. A looper who has an excessive exophoria can, through orthoptics, overcome this so she can do her work, and do it well. Inspectors and assorters are in the same group.

Actually, the salvage potential achieved through careful refraction alone, is very great. That type of salvage often requires refracting at the plant itself. In one precision plant, where the visual standards are necessarily high, every applicant not measuring up to these standards, would be lost if he were not refracted the same day at the plant. Thirty per cent of the applicants at this plant had visual defects that brought them below standard. It had already been proven that these people never returned if they had been told to "go out and get a pair of glasses and come back," as they always could get a job somewhere else without bothering with glasses. We had to refract in that plant on the day that the applicant registered. A breakdown of one group of 35 of these rejects showed that:

18 moderately below standard were brought to normal; 10 with serious defects would have been altogether rejected, but were brought to normal; 7 were rejected. In other words, 28 out of every 35 applicants otherwise rejected were salvaged each day. This plant grew from 2,500 employees to 6,800 in a year and a half. This is a salvage of human beings by nothing else than proper and plant-based refraction.

Ophthalmologists cannot do all of this refracting; we know that. What we have done in several plants, and what is being and will be done elsewhere, is to have a competent optometrist work with us. A qualified refractionist, trained especially for this type of work, is put on our payroll, not industry's; he is in there to refract, and that only. He carries out the policies and recommendations of the medical department. He studies and analyzes problems and brings them to us. He does not carry the responsibility of deciding *why* a person does not see, if not brought up to normal acuity with glasses. That is *our* job as medical people. I think that the time is coming—in fact, it has come—in which we shall need and want to have well-trained refractionists work with us in our private offices, and in our industries when it is necessary to refract at the plant. We ourselves need to carry the full responsibility of detecting all pathology, to take the overall charge of program, and sometimes to guide expert optometric assistance in refracting. Brickbats usually fly when this solution is suggested, as it is still an unorthodox one, but nevertheless it is a proper one and a necessary one.

In the matter of eye protective equipment, we share the responsibility. Prescription goggles are not a commodity; they are not like safety shoes or asbestos gloves. They are something that has to do with seeing. We need to know for ourselves and to emphasize it to the safety department (which usually handles the equipment or has charge of its care) that goggles must be adjusted individually. We need to impress management that someone has to go up and down the aisles with a service cart; that such an individual needs special training in order to dispense and to make the necessary adjustments at the operator's machine. If one is asked to lay out a goggles program (prescription goggles and regular plano goggles) it is well to insist on proper servicing; without it, the whole program may break down. One sometimes has to be with the dispenser when

he adjusts goggles at the machine. I spent almost three hours at different intervals with one man on a very complicated job, who was having trouble with his bifocals. It took special adjustments, it took changes of illumination, and it took effort and understanding to help that man.

The salvaging of goggles needs stressing. We should know something about custom-built frames for the man who has a broken nose or no nose (as we have had in two or three instances). These, too, are things that a safety man cannot handle. They are a combined medical and optical house problem. Proper interpupillary distances in goggles, as well as in occupational glasses, is one item with which we have also to be concerned.

Now let us discuss one of the most difficult of all close vision work problems—the proper occupational correction of loopers. A very curious thing happened when we sent the photographer to get a picture of a girl at a looping machine. A girl looping, actually is working at eight inches. Management was jittery about having anybody see a picture of a girl working at eight inches! Someone might assume that such work was injurious to the eyes. Then they would have labor trouble, maybe a strike! So when the photographer was around they were very careful to have the girl back away from her work and not be photographed at the real eight-inch distance!

This incident shows how badly we need to convince and reassure management. One does not have to be jittery about close work. We must help management solve these problems. If we don't help them, they have got every right to be jittery. Loopers have to put little prongs through the individual loops on hose. If they drop one stitch, they have spoiled the hose, which is later rejected. There are some 200,000 loopers in this country. They almost all do piecework. Their pay envelopes and their production rate depend entirely upon their accuracy at their work. Their accuracy depends on their eyes. So it was very important to do something to help these girls. Occupational glasses are often put into a light steel frame. We do not need to sell gold to industry. The frame must be exceedingly narrow, and the measurements made with her eyes focussed to her work distance, so that the interpupillary distance is for that work distance, not infinity, as ordinarily done. Otherwise, the girl would

have been looking through the edge of the lens instead of through the lens itself. A girl cannot do anything else except her work with this pair of glasses, so she leaves them at her machine. The further development of the use of occupational correction alone (where protection from hazards is not necessary) is going to be one of the major postwar developments in industry, in so far as eyes go. It is a field about which it behooves us to learn as much as we can as soon as we can. There are plenty of places where we need it for a war program; there will be even more places where we shall need it later on when management has time to analyze all the factors.

Many loopers and small parts assembly workers and near inspectors have an exophoria. Immediately we ask ourselves how much prism we need. Absolute rules and equations have not yet been established. By careful study of these phorias we gradually, by experiment and experience, determine how much prism base-in to incorporate in the prescription. Anything less than three degrees of prism is not worth anything. This can be a starter, from which to build up anywhere from 8 to 10 degrees. This is split between the two eyes, in lenses giving the necessary magnification, to see at that distance and to give comfort. The more plus, often the more prism is prescribed. Age, of course, makes a difference in the amount of plus and prism. These are many problems created for the optician in occupational correction, but these can be solved. Occupational correction was made for loopers and filament workers in England ten years ago. We here are just beginning to do it, and need to know a great deal more than we do, and there is urgent need for research and publication of attempts made. We need to experiment, to plunge into it, and to work with it.

There is an interesting and important relationship between distance acuity scores and production of hosiery loopers. The data from a group of girls in the looping industry was charted. The perfection of distance acuity was found to be inversely correlated with their production. The better they could see in the distance, the poorer their work was! These girls are mostly myopes and their distance acuity had absolutely no relationship with anything they did at a working distance of eight inches. You couldn't place them, you couldn't pick them, you couldn't correct them, you couldn't do

anything for that group of girls by merely recording their distance vision. Yet this is all that most industries record!

The effect of occupational eye wear on the production of learning loopers has also been studied by Professor Tiffin. Coinciding with the time that occupational glasses were provided, both the hourly earnings and the dozen pairs per hour picked up. The effect of occupational eye wear on the production of fine-gauge loopers is similar. Their hourly earnings and production of dozens per hour went up after correction. The turnover in this particular industry is enormous. These girls, placed without careful visual selection, are not able to do this type of work, and many won't be able to do it unless given proper occupational glasses.

The relation between near acuity scores and rate of production of radio tube assemblers is another instance studied. Excellence of near acuity correlates with production. Here, a record of distance acuity only would be useless.

I am going to take the liberty of saying a few words about screen testing techniques. The people we refract for industry directly, are those detected and screened out by mass testing. We all know that individual tests as made in our offices would be clumsy and time-consuming, and often impossible to conduct in an industry. The telebinocular is an excellent instrument and accurate, if we recognize its peculiarities. I do not know whether you know what those are, so I will mention a few of them. Most of you have seen the charts used with the telebinocular. These were originally designed for use in schools. They are almost impossible, and certainly very cumbersome, to use in industry.

The telebinocular tests for distance acuity are accurate. The depth perception test in the telebinocular is good enough to detect misfits for dangerous jobs. The percentage idea set-up is very bad and has unfortunately reflected itself so as to become almost a fixture in our thinking. Actually there is no scientific basis for a percentage scale in any instrument. There is an entity called instrument convergence, making it necessary to occlude one eye sometimes in determining acuity; for instance, a person can read no farther than 20/100 in the right eye. You occlude the left eye with a plain white card, and you will find that in about 30 or 40 per cent of the cases, that person will then come up to 20/20. This

latter record is the actual acuity of that eye. Neglect of this fact has produced the discrepancies noted between Snellen chart readings and those of the telebinocular. We can do much to straighten out such tangles when a plant uses this instrument. Muscle balance, on the Keystone record form, is not recorded in prism equivalents. We do know that when an individual is outside the range of "normal," that he does have a muscle imbalance. The color test is fair. Their near tests, except for the phorias, are conspicuous by their absence.

The other instrument possessing a battery of tests used for screening purposes, is the orthorater, which Bausch and Lomb designed specifically for industry. It has had the advantage of exhaustive checking, rechecking, with thorough validation of every single item in its scientific development. Extensive statistical analysis of its reliability has been made. The acuity test, which is a checkerboard, is a unique symbol shown to have the least amount of "guessing" potential. The near point tests for acuity and muscle balance are better, actually, than any individual test that we now have. All we have is the old-fashioned reading card held at any distance, without being really sure of where it is held. The mandate that only a specially trained lay technician be permitted to operate the instrument, and that the work and program be under the control of the medical department, is excellent. Recording of data is in code, by a technician trained not to know anything about the person as a patient. This, too, is an excellent feature. The fact is that it has proven to be a scientific "trouble-shooter" in many plants—this in addition to its use for testing applicants. As soon as there is trouble in any given department—too many rejects, lowered production, etc., that department is screen tested and the difficulties ironed out. The entire Service, including the use of the instrument, is rigidly laid down, and any violation or exploitation takes it away from that industry.

There is a vision screening instrument made by the American Optical Company. I have never seen it, but I understand it is being developed.

The new attitudes and the techniques of ophthalmology which have been given us, have created entirely new frontiers for us. These will change constantly as we meet new problems, and we must modify our practice to conform to these everchanging condi-

tions. A modern lathe is not what Dad used in the basement; an overhead crane is different from a gantry crane; a hooker is just a man who puts something on a hook; an expediter is not an assembly line operator. Shop vernacular is something for us to learn. Also we need to purge ourselves of our own academic vocabulary, and try not to use any 64 dollar words in the shops. They do not register; they do not click; they are going to confuse.

The rôle of an ophthalmological consultant is similar to that of a chemical laboratory. Management has a problem and says to us, "Here it is. It has to do with eyes. We want the answer." So we take ourselves out of our ivory towers and go out to find the answer to what they now call rightly their "visual bottlenecks."

The visual job analysis of any given plant is the best and only starting point, because it not only gives us the practical information but is a very thrilling experience for an ophthalmologist. Insist on seeing every listed job, or you may be caught. A conveyor line is a conveyor line—so I thought when I went through one plant. But one single girl on the line, out of hundreds, had a job in which she turned to pick something up and put it on a conveyor belt. The rest of them just stood there and did it; their eyes did not move, but this girl had to set a can in an exact position. She had a motion left, right; left, right, all day long. Her job was as totally different from the other conveyor jobs as if she were on another job entirely. There are no two lathes alike or no two assembly jobs alike. I feel that until we do learn to come out of our ivory towers and to leave behind us our "one and only way" of doing things, we cannot possibly meet the requirements of industry. We rarely use ordinary office techniques for industrial work. We have to meet industry halfway, which means meet lay management, employment directors, personnel directors, and safety men. We have to meet unions, believe it or not, individually through stewards, and in larger groups, to establish co-operation and to learn also. We need the backing of the union of a plant to put across occupational glasses programs. They have to understand what we are doing and why, and we have to understand what they are doing and why.

I think my own experience in industry has been worth a second college education to me. I have learned to give and I have learned to take. Our job is to accept our industrial assignment as it exists,

not as we would like to have it; to handle it with the least amount of disturbance to industry (because these folks are busy); to accept discomfort, noise, heat, dirt, danger, if necessary. And don't forget half of the industry works at night, and you will have to be there, too. Night workers do not want to be orphans.

It is up to us to provide practical answers, and not to aim to use industry to feed our private practice. Do not undertake to make a plant survey, then to put glasses on lots of people, to hand out office cards, to try to build up a practice. If we are to avoid creating boomerangs for industry and ourselves, we should work with industry as it needs us, not, necessarily, the way we do it in our private office. We can maintain accuracy and sometimes become even more skillful. To get the job done in the best way possible, to do it with eagerness and a desire for adaptability, is surely a major assignment. This is perhaps the Creed for the industrial ophthalmologist.

Ocular Lesions Due to Industrial Toxic Compounds*

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Introductory Comments

The growing use of poisonous chemicals in industry now presents one of the most serious hazards to the eyes of workers. This hazard is aggravated by the fact that thousands of men and women who are working with these compounds are wholly unaware of that fact, wholly unaware of the disease hazards to which they are exposed, and unaware of the steps they should take to guard against the harmful effects of these poisons. This is so because in many plants the poisonous chemical mixtures are usually trade secrets known to most of the employees who handle them only by some such designations as Solution B-3 or Compound C-4, the precise makeup of the material being known to perhaps only one or two persons in the plant. Since industry is being held responsible, more and more, for the effects of these toxic materials through their classification as compensable occupational disease hazards, there is an increasing necessity for the use of every known means to protect workers exposed to these poisons. In the meantime, it is the responsibility of every safety engineer, of every physician or surgeon having any industrial practice, and of every industrial nurse, to become familiar with all the poisonous substances used in their respective plants and to take all possible steps to protect the employees who are exposed to toxic compounds.[1]

According to Slyfield[2] more than 50 different toxic compounds are used in industrial processes, and at least half of these are more or less injurious to the eyes if handled continually or worked with at close range. Occupational diseases affecting the eyes are caused chiefly by chemicals and from the exposure to radiant energy.

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Absence of Reliable Statistics on Ocular Lesions Due to Industrial Toxic Compounds

Unfortunately, statistics concerning eye injuries are based on reports which, at best, are brief and often lacking in necessary information. Reports covering traumatic injuries are probably more accurate than the reports covering injuries or diseases of the eyes due to poisonous substances. The latter are more insidious and less spectacular in their action, but are just as disastrous. For this reason alone, the few statistics which are available on ocular lesions due to toxic compounds are on the conservative side. Consequently reported figures would tend to indicate that toxic materials either are not a big hazard or that reports covering such injuries are not filed with State Compensation Boards to the extent that they should be. In my opinion, the latter is probably the case. In discussing this troublesome phase of our problem, V. S. Karabasz, Associate Professor, University of Pennsylvania, in a speech to the Wood Products Section, of a recent National Safety Congress, stated:

> We know that the injuries reported are only a part of the total number of eye injuries which actually occur. Often the seriousness of an eye injury or the fact that it has or will result in the permanent loss of vision does not become apparent until long after the injury has occurred. More serious than the inadequacy of official records of eye injuries is the rapidly spreading use in industry of poisonous chemical and other deleterious materials which cause damage to the eyes. In many instances neither the workman whose eyes have been affected nor his physician knows that the worker has been exposed to poisonous fumes, liquids, or dusts.
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> In many other cases damage to the eyes develops after the worker has left the employment of the Company in which he knowingly or unknowingly, worked with or near poisonous substances. In either event the true cause of blindness or of serious damage to the eyes does not become a matter of record in the State Industrial Commission or in any other source of data concerning industrial injury or disease.

The industrial ophthalmologist should make a tour of the plant to learn the exacting and hazardous conditions under which the

men labor. Men complaining of headache or inflamed eyes should be sent in for consultation and examination.

Industrial Poisons Presenting Hazards to the Eyes

The continued introduction of industrial processes which necessitate the use of new poisonous substances has added to the number of toxic risks involving various forms of injury to the eye and its accessory nerves. The enormous increase in the production of dyestuffs and other chemicals since the last World War has augmented these risks considerably. The Bureau of Labor Statistics, United States Department of Labor, gives a list of fifty-two different toxic materials used in industrial processes; in at least half of the cases cited it is said that more or less serious injury to the eyes results from continuous handling of the poisons or continuous work in close proximity to them. Workers usually inhale these toxic compounds in the form of vapor, but the inhalation of dust may produce equally harmful results. Direct action of the poison through or on the skin is another method of entry; and sometimes the substance is admitted through food-stuffs, cigars, cigarettes, chewing-tobacco, etc., handled by the worker with hands from which the toxic material has not been completely removed.

In the United States the following substances are reported to be especially productive of serious results to the eyes: Ammonia, Benzol, and the other intermediates of the dye industry, Brass, Carbon Bisulphide, Dimethyl Sulphate, Hydrofluoric Acid, Lead, Methyl Alcohol, Methyl Bromide, Nitroglycerine, and Phosphorus. In Great Britain the principal substances that may be implicated are Lead, Derivatives of Benzene, Carbon Bisulphide, and Methyl Alcohol. These industrial toxic compounds or materials usually irritate the mucous membranes, giving rise to lacrimation and flashes of light before the eyes. Other results may be discoloration of the conjunctiva, disturbances of visual sense, retrobulbar neuritis, choroiditis, dilation of the pupils, photophobia, clouding of the cornea, diplopia from paralysis of the ocular muscles, amblyopia, protrusion of the eyes, contraction of the pupils, ulceration of the orbital bones, shrinking of the eyeballs, erosion of the cornea, transient blindness, progressive atrophy of the optic nerve, and permanent blindness.[4]

Resnick[3] lists these industrial poisons which affect the eyes, together with their principal effect or nature of injury:

ACETALDEHYDE—Irritation of mucous membrane of the eyes and respiratory tract.

ACETIC ACID—Inflammation of the mucous membranes, Conjunctivitis.

ACETONE—Irritation of the mucous membranes of the eyes and respiratory tract.

ACRIDINE—Irritation of the mucous membranes of the eyes and respiratory tract.

ACROLEIN—Irritation of the mucous membranes of the eyes and respiratory tract.

ALKALIES (Caustic Soda, Caustic Potash, Lyes, etc.)—Lesions of the conjunctiva and of the cornea.

AMMONIA—Severe irritation of the eyes, Conjunctivitis.

AMYL ACETATE—Irritation of mucous membranes of eyes and respiratory tract.

AMYL ALCOHOL—Irritation of eyes and respiratory tract.

BENZINE (Naphtha-Gasoline)—Visual disturbances, twitching of the muscles.

BENZOL AND ITS HOMOLOGUES—Conjunctivitis.

BERYLLIUM—Hyperemia of the cornea, Conjunctivitis, Blepharitis, Keratitis.

BROMINE—Conjunctivitis.

BUTANONE (Methylethyl Ketone)—Intolerable irritation of the eyes and nasal passages.

CALCIUM CYANAMIDE—Conjunctivitis, Ulceration of the cornea.

CARBON DISULPHIDE—Disturbances of sensation, particularly of sight.

CARBON MONOXIDE—Painfulness of the eyeball.

CARBON TETRACHLORIDE—Irritation of the eyes.

CHLORIDE OF LIME—Conjunctivitis, Lacrimation.

CHLORINE—Irritation of mucous membranes of eyes and respiratory tract.

CHLORODINITROBENZOL—Visual disturbances, Muscular twitching.

CHLORONITROBENZOL—Visual disturbances, Muscular twitching.

CHLOROPRENE—Irritation of mucous membranes of the eyes.

CHROMIUM COMPOUNDS—Irritation of the conjunctiva.

Cresol (Cresylic Acid)—Irritation of the mucous membranes of the eye.

Dimethyl Sulphate—Lacrimation, Conjunctivitis and photophobia; total or partial color blindness.

Dinitrophenol—Cataract.

Dioxan (Diethylene Dioxide)—Irritation of the eyes.

Ethyl Benzene—Irritation of the eyes.

Ethylene Dibromide—Irritation of the eyes.

Ethylene Dichloride—Irritation of the eyes.

Ethylene Oxide—Irritation of the eyes.

Formaldehyde—Irritation of the mucous membranes of the eyes, Conjunctivitis.

Formic Acid—Irritation of the mucous membranes of the eyes.

Gasoline—Visual disturbances, twitching of the muscles.

Hexanone (Methyl-Butyl-Ketone)—Intolerable irritation of the eyes and nasal passages.

Hydrochloric Acid—Conjunctivitis.

Hydrofluoric Acid—Intense irritation of eyelids and Conjunctivitis.

Lead and Its Compounds—Ocular disturbances.

Lime (Calcium Oxide)—Conjunctival and corneal lesions.

Methanol (Methyl Alcohol)—Affections of sight including Amblyopia, Optic neuritis, Conjunctivitis, Mydriasis, Nystagmus, Visual hallucinations, Blindness.

Methyl Bromide—Visual disturbances.

Methyl Chloride—Visual disturbances.

Metol—Inflammation of eyelids.

Naphthaline—Vesicular spots on the cornea, developing into ulceration, Chorioretinitis, Conjunctivitis, Cataract.

Nitrobenzol and Other Nitro Compounds of Benzol and Its Homologues—Visual disturbances.

Nitroglycerine—Sudden blindness in one or both eyes, followed by headache; later restoration of vision.

Nitronaphthaline—Visual disturbances.

Nitrous Fumes—Irregular pupil, Paralysis of the eye muscles, and Conjunctivitis.

Ozone—Irritation of the eyes and respiratory tract.

Paraffin—Irritation of the conjunctiva.

PETROLEUM—Irritation of the conjunctiva, Nystagmus, Disorders of the pupil, Mydriasis, Paralysis of the eye muscles.

PITCH—Conjunctivitis, Hyperpigmentation of the conjunctiva.

POISONOUS WOODS (Scented Wood, Iron Wood, Yellow Wood, Courbaril, Lignum Nephriticum, Bone Wood, Purple or Violet Wood, Red or Brazil Wood, Satinwood, Teak Wood, Greenwood, Cumaru Wood or Tonka, Cocus Wood, Black Ebony Wood, West India Mahogany, West African Boxwood, Maracaibo Boxwood, Magenta Rosewood, Tagayasan, Australian Mohwah Wood, Cocoloba, Sabicu and Others—See International Labour Office "OCCUPATION AND HEALTH," Vol. II, page 681)—Conjunctivitis, Irido-cyclitis, Keratitis.

PYRIDINE—Irritation of the eyes.

QUININE—Diminution of vision, Temporary blindness.

SULPHUR DIOXIDE—Irritation and inflammation of the mucous membranes of the eyes and respiratory passages.

SULPHURETTED HYDROGEN—Irritation of mucous membranes of eyes, Conjunctivitis.

SULPHURIC ACID—Severe inflammation of the mucous membranes and respiratory tract.

TAR—Ulcers of the cornea, Conjunctivitis.

TEA—Temporary blindness.

THALLIUM—Severe eye affections.

TOBACCO—Conjunctivitis, Amblyopia, Blindness (in connection with Alcoholism).

TURPENTINE—Irritation of the mucous membranes of the eyes.

Types of Lesions Due to Industrial Toxic Compounds

Being a superficial organ, the eye is directly exposed to dusts, vapors and gases of mineral, vegetable or animal origin, whether they are inert (acting mechanically) or active (acting through their caustic or septic characters). Lesions can be produced on the eyelids, the conjunctiva, the cornea and the lacrimal ducts. Diverse dermatoses, frequently occupational and often localized to the eyelids, deserve special mention, according to Coutela.[5] They have a peculiar chemical aspect due to the thinness of the skin and the extreme elasticity of the subcutaneous tissues. Some of these dermatoses are purely of toxic origin. Others, on the contrary, de-

velop only if there is an individual predisposition. The mineral elements may be of a well determined nature, such as lead (used in vinegar factories), mercury (used in conditioning fur skins), arsenic and sulphur (employed by vine sprayers). Any vapor can cause an ocular disturbance, even that of chromic acid, which gives rise to black staining of the cornea. Some other elements are of a more complex nature, such as the ammoniacal vapors, which affect scavengers and cause keratitis in workers in artificial silk, the chemical fertilizers, war gases and coal derivatives, which cause the dermatoses of coal miners. The lesions due to tar and resin can progress from common irritation to folliculosis and even to the malignant condition. It is generally admitted that external irritation can produce a precancerous state, which in some predisposed persons gives rise to a cancerous metaplasia. Added to this list of irritants are aniline and its derivatives (so frequently used in the manufacture of dyes), the solvents and cellulose varnishes (so widely used at present), methyl alcohol, powders and explosives (nitronaphthalin).

The vegetable elements are numerous: indigenous and exotic woods, flowers, hops, flours, vegetables, mushrooms, tobacco and pharmaceutical products, among which are podophyllin, which causes corneal and iridic lesions, turpentine, mustard, vanilla, lac and amber. Manchineel wood can provoke ocular disturbances with deafness in persons who work with it.[5]

Among the elements of animal origin which may effect vision are fur skins (removal of coarse hairs sometimes giving rise to visual disturbances, mostly through the medium of the nasal and post-nasal cavities), hairs, wools, caterpillars and mother-of-pearl.[5]

Being highly vascularized and enervated, the eye is exposed to intoxications from lead, sulfocarbonate, and hydrocarbons such as benzene, trichlorethylene (causing involvement of the trigeminal nerve).[5]

Systemic Effects of Industrial Toxic Compounds

A large variety of industrial poisons give rise to transient affections of the eyesight, and some of them to permanent effects. Various toxic compounds may give rise to any one or more of these conditions, depending upon the strength of the poison and duration

of the exposure. Especially hazardous are the vapors of dinitrobenzol which is used in the manufacture of high explosives. Other substances which formerly produced much eye trouble have been eliminated from modern processes of manufacture or the operators are better protected by the wearing of respirators and goggles, as well as by the installation of exhaust fans. Such substances are iodoform, volatile coal tar products used in dyeing, and arsenic, formerly used in cosmetics and in the coloring of wall papers, artificial flowers, and paints.[6]

Prominent among the group of protoplasmic poisons which produce blindness through inflammation of the optic nerve, acute or chronic, are: alcohol, nicotine, carbon disulphide, trichlorethylene and the arsenical compounds. There is another group of internal poisons which produce blindness through other forms of inflammation and disease of the retina. Poisons of this group, instead of acting directly on the nerve fibers, affect the nerve secondarily through contraction of the small blood vessels of the nerve or retina, or through changes in the blood. In this group may be found lead, quinine, cocaine, sodium salicylate, silver salts, mercurial preparations, amyl nitrite and nitrous oxide gas.[7]

Toxic Amblyopias

Toxic amblyopia is a partial or complete blindness caused by a toxic substance which interferes with the function of the retina, the optic nerve or the more central optic pathway. Every new drug used in medicine and every new chemical used in industry is a possible cause of toxic dimness of vision so that this subject is constantly growing in scope. Victims are becoming more and more compensation-conscious and the ophthalmologist, in order to be fair to both employer and employee, must have a thorough understanding of this subject.[8] The most common substances which produce these effects are methyl or amyl alcohol, tobacco, iodoform, naphthalin, acetanilide, salicylic acid, atoxyl, arsenic and several drugs used as worm medicines, such as felix mas, santonin and pomegranate.[9]

Symptoms.—The first sign of toxic amblyopia, according to Benedict,[7] may be misty vision. Persons who have been exposed to poisons which effect the optic nerve or the retina as a rule complain

of temporarily disturbed vision as a first symptom. Recent color blindness is an early symptom of poisoning by either of the two groups listed by Benedict. Another common symptom is disturbed vision described as heat waves. Diminished sharpness of vision and general depression of the visual fields bring the victim to an oculist usually with a request for glasses. The characteristic changes in the fields are central, blind or partially blind area in the visual field and disturbances in the color field. There may be deficiencies in accommodation.

Classification of Toxic Amblyopias.—Carroll[8] divides toxic amblyopias into three groups. I—Those caused by poisons which produce cortical or central blindness, II—Those caused by poisons depressing the entire visual field, but more especially the peripheral fields, and III—Those caused by poisons depressing exclusively or chiefly the central visual field. He writes[9]:

> In cortical blindness there is a complete or almost complete loss of vision but the pupils react to light because the lesion is above the light center. One of the several causes of this condition is uremia (presence of urine constituents in the blood). Acute carbon monoxide poisoning as a cause of Toxic Amblyopia is a definite entity, but whether chronic carbon monoxide poisoning ever causes optic nerve damage is questionable. Carbon monoxide may be encountered from illuminating gas, fumes from automobiles, mine gas, furnace gas and sewer gas. Infrequently optic nerve injury may result following or during anesthesia; the latter condition is probably due to anoxemia. Complete blindness in a person suffering from acute alcoholism whose pupils react normally to light is probably due to acute alcoholic amaurosis (blindness occurring without any apparent injury to the eye). The prognosis is excellent and the patient is usually well in 24 hours. It is important to differentiate this type of poisoning from methyl alcohol amblyopia.
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> The second group of Toxic Amblyopias are those caused by poisons depressing the entire visual field but more especially the peripheral field. Barbiturates are usually a cause of amblyopia only when used in very large doses. A cause of amblyopia found among makers of artificial leather, rubber cementers, dry cleaners, engravers, lacquer makers and vulcanizers is Benzol (Benzene). Dinitro-Benzol also may be a causative agent. Blood loss which occurs in patients whose general health is below par or whose red blood cell and hemoglobin are

markedly reduced sometimes causes this condition and treatment with transfusion is advisable. Toxemia resulting from burns may produce encephalopathy (disease of the brain), retinal hemorrhage and amblyopia. Carbon tetrachloride which is used both for cleaning purposes and as an anthelmintic (remedy for worms) may be a causative poison in some cases of amblyopia.

Methyl alcohol is a recognized cause of optic atrophy (a wasting of the optic nerve) as evidenced by the occurrence of this condition among painters who, when working in closed spaces, inhale the fumes of wood alcohol. The same danger exists for persons using wood alcohol in lamps. Children have been known to develop optic atrophy as a result of the external application of methyl alcohol in sponging. Taken by mouth the poison usually produces abdominal pain, vomiting and poor vision. Recovery in these cases is often followed by relapse.

In the third group of Toxic Amblyopias are those poisons which depress, exclusively or chiefly, the central visual field. Carbon disulphide, used widely in the rayon industry and also in the preparation of rubber, explosives, hides, insecticides and in the wool industries produces this type of amblyopia. It is usually accompanied by polyneuritis and other evidences of toxemia. Lead poisoning is found to be a cause of amblyopia in patients who are compositors, plumbers, storage battery makers and even in children who have eaten the paint from their cribs.

Thallium which is used by women having excessive hair growths as a depilatory and in industry as a rat poison usually produces peripheral neuritis preceding any visual disturbance.

Tobacco-alcohol poisoning is the most common and the most important Toxic Amblyopia seen in this country. It comes on gradually and occurs in an age group which may show some senile changes in the eye. It is important to differentiate this from macular degeneration (opaque spots on the retina) because the prognosis is good in tobacco-alcohol amblyopia and poor in senile macular degeneration. Recent research has shown that it is possible for patients with this condition to continue smoking and drinking and recover completely providing an adequate amount of vitamin B is taken.

Thompson[6] tells us that of eye diseases due to circulation of toxic materials in the blood, the effect is transient and immediate, causing double vision and dizziness (vertigo), acting mainly through the cerebral visual centers. In other cases the effect accompanies

symptoms of general systemic poisoning and is of the nature of chronic inflammation of the retina and optic nerve, causing partial or complete blindness. Some of the toxic metals afford striking examples of these symptoms. Thus double vision has been reported by one author[6] as associated with "Brass Chills" among those workers in brass foundries and brass polishing.

Principal Industrial Toxic Substances Injurious to the Eyes

Let us now consider in a little more detail some of the principal industrial toxic substances, which cause amblyopias and have other injurious effects on eyesight.

Lead.—Lead poisoning, which is one of the greatest toxic hazards in industry, is usually caused by the inhalation and absorption of its dust or fumes and may be acquired in a great many trades. Lead is particularly liable to injure the eyes of painters, file cutters, plumbers, electrotypers, typesetters and cleaners, pottery glazers, storage battery makers, paint grinders, and makers of red, white, orange and yellow lead, makers of lead pipe, tinsmiths, solderers.[6] The effects of poisoning by lead are very widespread in the body, but tend particularly to be localized in the nervous system. Inflammation of the optic nerve of one or both eyes is not uncommon in chronic lead poisoning and is associated with inflammation of the retina which may produce total blindness. Paralysis of the ocular muscles and dimness of vision have also been found in lead poisoning; recovery usually occurs.[10] Lead causes serious central, as well as peripheral, eye diseases, such as inflammation back of the eyeball, and paralysis. MacNalty states[4] that the prevention of visual impairment and blindness due to lead poisoning is a part of the prevention of lead poisoning and that where stringent precautions are enforced there will be few cases of blindness. In support of this statement he points out that in the past, cases of blindness due to lead poisoning were usually found in institutions for the blind, whereas at the present time there are practically none.

Arsenic.—This toxic material is used extensively in the manufacture of insecticides, artificial flowers, "Paris Green," in glass mixing, photoengraving, pickling and soldering, dyeing, pottery decorating, and in ore-refining. In the trades there have been reported cases of miners' arsenical poisoning with atrophy of the

optic nerve resulting. This has followed exposure to dust from the mineral known as sulpharsenide of cobalt. Arsenic is usually found in nature in the form of arsenical pyrites and apparently does not cause any injurious effects in this state. Medicinal or cosmetic use of forms of arsenic may cause eczema of the eyelids, conjunctival irritation and occasional toxic amblyopia and optic neuritis.[9]

Carbon Bisulphide.—Several cases of toxic amblyopia have been reported from the use of carbon bisulphide in the rubber industry. Carbon bisulphide is used in the curing of rubber, but its present use is not so extensive as in the past.[9] It is also employed in the rayon industry and in refrigerating plants, and produces a vapor which injures vision by affecting the retina or optic nerve. The uncontrolled use of carbon bisulphide acts quickly on the central nervous system, producing optic neuritis. Progressive failure of vision due to retrobulbar neuritis has been recorded. Other conditions reported are severe amblyopia, and ocular disturbances, (retraction of the visual field, and some disturbance of color vision) going on to amblyopia in a few cases; fatigue of accommodation has also been noted.[4] Carbon bisulphide is distinctly poisonous to the central nervous system, particularly to poorly nourished neurotic persons, and causes optic atrophy, neuritis and cerebral degeneration. Early symptoms as reported by Benedict[7] are disturbances of central vision, loss of appetite, diminution of visual acuity which in a certain number of cases develops early in poisoning and progresses without pain. A large number of eye injuries occur in the rayon industry to workmen in the spinning room where irritations are caused by a combination of mist containing about eleven per cent sulphuric acid in addition to the carbon bisulphide. British investigators found that, as the result of an isolated exposure of a few hours' duration, to a concentration of only one part of carbon bisulphide by volume in 3,000 parts air, severe headache and mental dullness or confusion usually results. If such exposures are of daily occurrence, the symptoms become increasingly severe with inflammation of the nerves, distorted vision and mental disturbances.[11]

Hydrogen Sulphide.—Hydrogen sulphide is an irritant and toxic gas which may be formed in the chemical industry in a variety of processes, as for instance in the manufacture of carbon bisulphide, of sulphur dyes, and of soda according to the LeBlanc process.

Exposure to hydrogen sulphide may also exist in the rubber industry and in the rayon industry where the viscose process is used. The toxic effects produced by hydrogen sulphide vary considerably with the concentration to which a person may be exposed. Its irritant effect, however, is most conspicuous on the membranes of the eye and it may result in very painful conjunctivitis with marked injection, lacrimation, photophobia, and occasionally in defects of the cornea. It appears that under certain conditions such defects may be the first and main symptom, leading to foggy vision and other disturbances such as colored rings around the lights, which may be due to interference phenomena. The defects represent punctated erosions of the cornea[12] which in severe cases may flow together and in which the epithelial layers are loosened; this condition may be preceded by a period of scaling.[13] It is of great importance that all those handling hydrogen sulphide or who may be exposed to it be informed regarding its toxicity and potential dangers. It is also essential that, in all operations where hydrogen sulphide may contaminate the air, the concentration of 20 parts per million or less be maintained by proper exhaust ventilation, preferably at the site of the formation of the gas. Conjunctivitis resulting from exposure to hydrogen sulphide may be treated by instillation of 1 drop of olive oil which is said to alleviate the pain. In severe cases, administration of 3 to 4 drops of 1:1,000 solution of epinephrine every 5 minutes, for three or four instillations, may prove helpful. If the pain becomes very severe, local anesthetics and hot or cold compresses may be of benefit.[14]

Carbon Monoxide.—Carbon monoxide produced by the imperfect combustion of gasoline may be so prevalent in garages and automobile repair shops as to produce disturbances of the optic nerve and the retina.[15] The literature on carbon monoxide asphyxia contains a fair number of reports of permanent damage to vision. Drinker[16] has found that as a rule, serious eye injury requires severe poisoning, that is, poisoning in which there is a long period of unconsciousness. But there are rare cases which are exceptions to this rule. We are told that in most cases of visual disturbance following carbon monoxide asphyxia, the lesions are in the vital part of cells of the different ocular nerves. The effects may be permanent, as in the case of other cerebral damage due to carbon monoxide,

or they may be quite transient. When permanent, they are to be distinguished from hysterical phenomena, so often found after mild poisoning, by the presence of nervous or mental symptoms indicating damage to the nervous system, or by definite lesions in the eyegrounds.

Methyl Alcohol.—Methyl alcohol or "Wood Alcohol" is extensively used as a solvent for shellacs, varnishes, and finishes in the manufacture of many common articles, and in the preparation of perfumes, paint removers, denaturing spirits, production of coal tar colors, as a solvent for aniline dyes, and in toilet preparations. The inhalation of its vapors for a long period of time may cause changes in the optic nerve, leading to partial or total blindness. The ingestion of methyl alcohol is more apt to produce blindness from atrophy of the optic nerve.[9] Amblyopia, which is bilateral, occurs within a few hours of exposure or sometimes after several days. Often transient at first, it recurs and may be followed by complete and permanent blindness. Before actual blindness occurs there may be pain and tenderness on pressure of the eyes, dilated pupils, fogginess and blurring of the vision, diplopia, or ptosis. There is an increasing contraction of the visual fields for form and color, congestion of the sclera, pallor of the disk, central scotoma, and much reduction of visual acuity. The exact etiology of the atrophy present is still in question.[4] Methyl alcohol is soluble in such lipoid substances as are found in nerve tissues, and after death the brain retains a large percentage of this alcohol. A highly differentiated nerve substance like that of the optic nerve is therefore particularly liable to be affected by it.[6] It has been thought for a long time that wood alcohol attacks the eyes especially, but recent researches have demonstrated that this is not a special attack on the eye but that the eye is merely indicative of the response that goes on in the brain and other tissues, and that the blindness produced or the effect on the vision is simply discerned more readily. There is nothing so outstanding or dramatic as any effect on the eyes.

Derivatives of Benzene.—The chief of these benzene derivatives are dinitro-benzol and trinitrotoluene. Dinitro-benzol, used in the manufacture of aniline dyes and the production of high explosives, produces a distinct toxic effect on the vision similar in many respects to that caused by carbon bisulphide. Its effects are found

in varying degree in all those who suffer periodically from subacute attacks of poisoning. Susceptibility may aggravate the symptoms, but no worker can claim perfect immunity. It is highly toxic and affects the general system of the body chiefly through absorption by the skin, or by inhalation. Optic neuritis may be a concomitant of such poisoning, but there is no record of the eyesight, being seriously affected by dinitro-benzol in Great Britain since 1914.[4] Comparatively few complain of any impairment to their eyesight, but probably about one in ten are unknowingly affected. The use of dinitro-benzol has been responsible for the inception of toxic amblyopia in certain cases of exposed workers.[9] Snell summarizes his conclusions regarding the effects of dinitro-benzol thus:[17]

> Failure of sight, often to a considerable degree in both eyes, concentric contraction of the visual field, within many cases a central color scotoma, some blurring, never extensive, of the edges of the disc, and a varying degree of pallor of its surface.

In all cases absence from exposure removes these symptoms in a varying length of time, and usually a restricted exposure will alleviate them.[17]

Trinitrotoluene is much used in munition work during war time, but no certain cases of optic neuritis due to its employment have been reported.[4]

Aniline.—There have been complaints of irritation of the eyes and loss of vision from the inhalation and absorption of aniline material in the manufacture of coal-tar products and in dye factories.[9]

Volatile Toxic Substances.—Many volatile substances when they reach the blood through absorption may seriously affect vision, acting either directly upon the structure of the eye or affecting it through cerebral deficiency by the quality or quantity of blood in brain vision centers. Vapors of some of the volatile solvents are absorbed through the lungs and cause damage to the body, the eyes included. Any substance that will cause swelling due to accumulation of a fluid in the tissues of the brain and other organs will cause a similar response in the eye tissues. This may cause dilation or constriction of the blood vessels and if prolonged or repeated frequently may result in damage to the eyes. The eye is the only

window through which we can actually look inside the body and see the physiological changes which are taking place as the result of the poisonous material, not only in the eye, but elsewhere in the body, particularly in the brain. It is not uncommon for some people to be extremely sensitive to amines, aldehydes, mercaptans, and thio-cyanates, and, therefore, it might be well to be alert to the possibilities of hyper-susceptibility. Many of these compounds have an irritating effect on the eyes.[18] Cases of more or less marked loss of vision have been reported. In some of these, there was loss of color sense without visible change in the eyeground. Trichlorethylene must also be added to the volatile substances used in industry which have a selective action on the optic nerve. An indirect form of injury to the eye is noted by German factory inspectors, who have found corneal ulcers resulting from a foreign body in the eye which the workman had not been aware of because the cornea was rendered anesthetic by the fumes.[19]

Occupational Keratitis and Corneal Dystrophy

Keratitis may be defined as an inflammation of the cornea. Corneal dystrophy is a condition in which there is defective or faulty nutrition of the cornea. Occupational keratitis as well as several other forms of keratitis are treated by Fuchs[20] under diseases of the conjunctiva, and occupational conjunctivitis is defined as "an acute conjunctivitis found in certain industries where irritants—acrid vapors, liquids, or dustlike particles—get into the eyes either by accident or as part of the day's work." Under conditions allied to corneal dystrophies are further described changes produced in the deeper layers of the cornea by the continuous action of various substances, such as lime, lead, silver, nitronaphthalin and iron (siderosis). Occupational superficial punctate keratitis is an inflammation marked with points or dots on or near the cornea produced by occupational exposure and has been found among workers with lacquers in the furniture and metal industries, in mushroom canning, among workers in the straw hat industry and in agricultural workers on reclaimed marsh lands in California. Rankine[21] who reported on 1,598 workers in the acid house in the rayon industry, listed the symptoms as blurred vision and halos, grittiness, abnormal intolerance of light, discharge of tears, eyelid

muscle spasm, aching back of the eyes, and headaches. Burning and stabbing pains increase toward the end of the day and working week and the symptoms are most marked during the winter months when the ventilation of workrooms is poorest. All writers stress evidence of individual predisposition in the form of frequent recurrences in some persons and immunity of other neighboring workers.[22]

The outstanding offending agents appear to be hydrogen sulphide, principally in the rayon and sugar industries; also mines and tunnels, benzol and similar solvents and diluents of varnishes, shellacs and lacquers. Many writers, such as Klein[23] and Büchlers[24] stress the effect on the cornea of the drops scattered by spinning and spraying rather than the gases involved, in artificial silk industrial processes, as the factor responsible for the eye conditions found. According to McDonald[25] hydrogen sulphide containing droplets of acid bath are responsible for keratitis among the workers in the rayon industry. He found the condition more marked in damp weather and stated that a concentration of ten parts per million is permissible. Other of the important agents considered in the textbooks and in the literature are hydrogen fluoride, tar pitch, mercury and silver sublimate, certain kinds of wood and lead nitrate. The victims all get well with change of occupation, and there is complete return to health in from seven to ten days.[22]

Davidson[22] asserts that true occupational dystrophy such as is reported in textbooks and in the literature, has not been observed. Cases of dystrophies as after-effects of accidents have, however, been encountered. For example, examinations prove that a degenerative process goes on in the cornea with lime incrustation in the course of years in connection with lime burns. These manifestations may be delayed and present problems in the differential diagnosis between injury and disease.

Conclusion

One of the popular fallacies concerning eye hazards is that of regarding some operations as involving so-called "minor" hazards, thus calling for minor protection. It should be the axiom in safety practice that there is no such thing as a minor hazard, insofar as the eye is concerned; for at any moment an innocent enough operation may develop a major risk. These symptoms are warnings

that something should be done promptly: headaches; eye aches; tired feelings on using the eyes; blurred vision; inflammation or soreness of eyes or lids; watery eyes; swelling, puffiness, or drooping of lids.

Ocular defects, impaired vision due to effects of toxic industrial compounds and organic diseases of the eye not only reduce vision, both central and peripheral, but by causing distortions, blind spots, illusions, etc., handicap the worker's control of a large percentage of his physical actions.

It is a shortsighted policy to do nothing to safeguard vision because the ideal facilities are not at hand. If the services of an ophthalmologist are not available, then the combination of industrial physician and optometrist may be found satisfactory or, lacking these, a nurse trained in eye work can be of great value if the limits of her training and responsibilities are understood. Obviously, all reasonable effort should be made to reduce exposure to hazards affecting the eye by the installation of necessary facilities for preventing and eliminating atmospheric contaminants and by the provision and required use of effective protective devices such as goggles and masks. It is also neither kind nor safe to permit a man with an active ocular disease to jeopardize the safety of himself and those about him by attempting to perform work which requires accurate visual supervision. It is the responsibility of every safety engineer, of every physician or surgeon having any industrial practice, and of every industrial nurse, to become familiar with all the poisonous substances used in their respective plants and to take all possible steps to protect the employees who are exposed to these poisons.

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Industrial First Aid in Chemical Injuries of the Eye

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I SHOULD like to begin this discussion by reading one paragraph which I think represents the consensus of those full-time industrial physicians in the large industrial plants, where there are well planned and operating medical departments:

> Of all the commonly occurring injuries seen in industrial practice, those to the eye carry the most serious potentialities for permanent, serious disability. Proper early treatment, however, can usually greatly minimize or prevent such a result. It must be re-emphasized, therefore, that all but the most trivial of eye injuries should be promptly referred to an ophthalmologist if the welfare of the employee, the pocketbook of the employer, and the reputation of the industrial physician are to receive maximum protection.

There is a crying need in most small, industries for "standing orders" that can be carried out by the nurse in industry. This need is accentuated by the really remarkable accomplishments of your society. You have devoted much time and effort in getting across to the layman as well as the nurses and physicians in industry that in the event an irritant chemical has entered the eye, the first objective should be the immediate removal of the offending agent. This can best be accomplished by immediate irrigation of the eye with copious quantities of clean running water. The patient should then be sent directly to the Plant Medical Department. If there is an irritant reaction or a burning sensation from the material, the patient's eyes should be flushed with water immediately at the site of the accident.

Traumatic injuries should not be touched at the site of the injury but the patient should be sent directly to the Plant Medical Department.

After the above first-aid treatment at the scene of the accident,

the following treatment should be carried out in the Plant Medical Department:

(1) Test reactions of the contents of the conjunctival sac by lightly touching indicator paper to the mucous membrane surfaces of the lower fornix. (Litmus paper is poor because a large pH shift is required before a color change from the blue to red or from red to blue occurs. Alkacid test paper or pHydrion paper is much better because definite and easily recognizable color changes take place with a pH shift as small as 0.2 of pH unit. Nitrazine paper is satisfactory for acid burns, but poor for strong alkali burns.)

(2) Local anesthetic should be placed in the eye.

(3) Thoroughly wash the eyebrows and tegument surrounding the eye in order to remove all residual chemical or foreign particulate matter which may be present. This may be done while the anesthetic is taking effect.

(4) Copious irrigation of the eye with saline or distilled water should be immediately instituted.

(5) Place two drops of a 2 per cent sodium fluorescein solution on the eye, allow a minute for staining of any denuded area, and then rinse with physiological saline.

(6) Examine the eye under a Hague cataract lamp, or a strong beam of light, with the aid of a magnifying lens. This should be followed by slit-lamp examination.

(7) If there is still discomfort after the above procedure, local anesthetic may again be placed in the eye, then followed by irrigation.

Definitive Treatment for Acid Burns

(1) Cold lavage compresses, changed every 3 to 5 minutes for a period of 1 to 3 hours. Mild reducing or oxidizing solutions are recommended. While the duration of this irrigation will depend upon the cause, type, extent and severity of the injury, the irrigation should always be continued until there is a maintained neutral reaction upon testing the secretions in the fornices.

Note.—Most acid burns of the eye are instantaneous and not progressive, and consist essentially in the precipitation and perhaps denaturing of the tissue proteins. The severity of the burn seems to depend upon the pH of the acid, the degree of dissociation, the character of the anion, and, most important, the time that the acid remains in the eye before it is diluted and removed. As a general

rule, acid burns heal more rapidly and are much less difficult to handle than alkali burns.

(2) Local anesthetics generally used are pontocaine, butyn, holocaine. Most uncomplicated cases of acid burns require a local anesthetic, an oily lubricant, and some non-irritating bacteriostatic substance, such as penicillin or streptothricin in the cul-de-sac during the first 24 hours. In every burn of the eye a symblepharon may develop if two denuded mucous membrane surfaces are approximated and immobilized. Liberal quantities of such ointments, together with twice daily compulsory inspections, will prevent many a symblepharon.

(3) Dark glasses, atropine, eye pads—the advantages to be derived from any or all of these, when needed, should not be overlooked.

As a general rule, acid burns are not progressive and secondary treatment is largely symptomatic. Additional measures include the use of the following:

a. Boric acid and ophthalmic ointment, together with an eye pad, or the instillation of sterile castor oil, cod liver oil or olive oil. (These will alleviate the symptoms which usually accompany acid burns, as well as promote regeneration of the corneal epithelium.)

b. Removal of any discharge from the fornices by instillation of a mild silver protein 10 per cent solution followed by copious irrigations of boric acid.

c. Butyn and metaphen ointment. (Rapid but short-acting local anesthetic.)

d. Metycaine and merthiolate (slower than butyn but more prolonged action).

e. Holocaine (phenacaine) 1 per cent should be used. (Cocaine should not be used in view of the fact that it delays healing, softens and swells the cells, and produces further damage to the epithelium.)

f. Secondary infections are best treated with penicillin ointments, 250 units of the dry powder suspended in 1 cc. of mineral oil.

Definitive Treatment for Alkali Burns

(1) Cold lavage compresses, changed every 3 to 5 minutes for a period of 1 to 3 hours. Mild reducing or oxidizing solutions are recommended. While the duration of this irrigation will depend

upon the cause, type, extent, and severity of the injury, the irrigation should always be continued until there is a maintained neutral reaction upon testing the secretions in the fornices.

Note.—Since alkali burns, unlike acid burns, are nearly always progressive, there is a great deal that the first aid as well as definitive treatment has to offer, and especially does this apply to the benefits that will accrue from the continued irrigations with a mild buffer solution. In many cases it is advisable to keep these irrigations up for one-half hour or more.

(2) Cold compresses together with penicillin or streptothricin are useful in inflammatory affections of the conjunctiva. Edema of the lids and chemosis, so frequently seen in these burns, may be measurably reduced by a small cotton ball saturated with buffer solution, covered with a 4 x 4 inch gauze compress moistened in the cold buffer solution placed over the lids, or by the dry method (ice-bag), which, as a rule, is less painful to the patient if the skin of the face and forehead is protected. Ice should never be applied to the lids directly.

Note.—Since strong alkali solutions penetrate deeply into the cornea within a very few seconds, a resultant corneal ulcer may be anticipated by the swollen corneal stroma with leukocytic infiltration. Frequently the cornea temporarily becomes less cloudy, but on the fourth to eighth day a pannus of blood vessels enters the cornea from the limbus, over which the corneal epithelium does not regenerate. In the event the cornea or conjunctiva is severely burned and appears white or gray, a symblepharon or corneal lesions, including adhesions between the lid and the eyeball, may develop.

(3) Dark glasses, atropine, eye pads should be used as required.

Additional routine measures in the treatment of alkali burns of the eye should include:

a. Instillation of atropine sulfate—1 per cent ophthalmic ointment or solution (the solution when irrigation, the ointment when oil is used).

b. Careful twice-daily inspection for adhesions between the lids and the globe. (A glass rod—cocktail stirrer—is very useful in breaking these adhesions.)

c. Liberal quantities of boric acid ointment placed between the

globe and lid to act as a barrier and serve in prevention of further adhesions.

d. Any discharge removed from the cul-de-sac by the instillation of a mild silver protein 10 per cent solution, followed by copious irrigations of boric acid.

e. Penicillin or streptothricin ointment, 250 units per gram of petrolatum, is a very useful agent in preventing secondary infections.

Definitive Treatment for Superficial Foreign Bodies in the Eye

It is of the utmost importance that the patient be placed in a satisfactory position which will allow for perfect comfort and relaxation on the part of the patient as well as on the part of the physician.

These objectives can best be accomplished by the following:

(1) Place patient in reclining position.

(2) Administer local anesthetic, butyn, or pontocaine.

(3) The physician should sit at the patient's head. His elbows should rest on the cot, with his hands and face in such a position that he is looking and working from above downwards over the globe of the patient's eye.

Note.—There is much less danger of causing damage to the eye in this position than in having the patient sitting in a chair and the operator working from a sitting position in front of the patient. Working from in front, a slip of the physician's instrument is almost certain to result in puncturing or otherwise severely damaging the patient's eye—working from above, a slip is likely to give only a tangential injury of much lesser severity.

(4) No patient should be allowed to leave the dispensary after a foreign body has been removed from the cornea or conjunctiva without first placing onto the bulb a couple of drops of 2 per cent sodium fluorescein solution or aqueous mercurochrome. Frequently in cases where there is a history of a foreign body but no foreign body is found, fluorescein instillations will reveal scratched surfaces of the cornea which are missed without the staining aid.
I have found the Hague cataract lamp to be of great assistance since it furnishes a source of ultra violet light which may be used together with fluorescein to produce the fluorescent phenomenon on the stained cornea.

Ophthalmological Guidance for Nurses in Industry

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UNDER medical direction and with proper guidance by ophthalmologists, the nurse is an important factor in a sound program for care and protection of eyes in industry. However, responsibilities for eye care delegated to nurses differ markedly from those which nurses are expected to meet in any other branch of nursing, and are often far greater than in hospital nursing or in any of the other public health nursing fields. Furthermore, nowhere in their nursing education do nurses receive an adequate preparation for many of the duties relating to the protection of eyes which they are expected to undertake in industries.

As is well known, few schools of nursing are able to give experience in the nursing care of patients with eye conditions to all of their students and must limit their instruction to ophthalmological lectures. Even where available, experience in ophthalmic nursing is usually quite limited and seldom do student nurses have any practice in personally handling an emergency eye case or in giving vision tests. No one can be more aware of these deficiencies than the nurses themselves and they are looking to ophthalmologists for guidance and help in determining the scope of eye services the nurse should render in industry and in learning how to perform them competently.

What are some of these duties? A recent study of nursing services in 924 industries found that nurses' functions range from "strictly first aid" to "an all-inclusive program" of health promotion in industry as currently conceived. This consisted of care and treatment of injured and ill workers, assistance in medical examinations including tests of vision and in plant sanitation, participation in health and safety education and in welfare activi-

ties, visiting nurse services in the homes for ill workers and, in some cases, for their families.

The scope of the responsibility of nurses for eye care in industry is further indicated in two recent publications—"Nursing Functions in Industry"[1] and "Nursing Care of Eyes in Industry."[2]

It is a fundamental principle that nursing service is rendered only under a licensed physician, but in the survey already referred to 77 per cent of the nurses were found to be in plants employing physicians only part-time or on call. This makes written standing orders, approved and signed by a physician or panel of physicians, imperative. Furthermore, even where the nurses work under full-time medical direction they should be provided with written outlines of procedure approved by the medical director. Such of these standing orders and routines as relate to eye care should be subject to review by consultant ophthalmologists. Most plant physicians would undoubtedly welcome such assistance in guiding nurses and first-aiders working under their direction.

While in many of the larger industries nursing service is available in the emergency departments during all the working hours, in others first aiders cover the emergency room except during the day shift. This service should be under the plant physician's or nurse's direction and should also be subject to ophthalmological guidance. Standing orders for emergency care should vary in relation to the abilities of the person who will give the care.

However, in rendering such services ophthalmologists need to be familiar with the eye problems and the factors controlling the scope of the nurse's duties in the industry in question. In the survey of nurses' functions in 924 industries, already referred to, a number of factors were found to determine the type of services rendered by nurses in an industry. Important among these were attitudes and policies of management in relation to health services for workers. These may either put undue restrictions on the nurses' duties or, conversely, nurses may be urged to undertake activities which do not lie within their proper sphere. It was also found that the administrative set-up of the medical department greatly influenced

[1] *Nursing Functions in Industry.* National Organization for Public Health Nursing, 1790 Broadway, New York 19, 1943.

[2] *Nursing Care of Eyes in Industry.* National Society for the Prevention of Blindness, 1790 Broadway, New York 19, 1944.

the scope of nursing activities. Here it is of interest to note that nurses' responsibilities are usually far greater under part-time or on-call physicians than under full-time medical directors. This is natural but there is, of course, considerable danger in this situation, particularly when it is remembered that in the absence of a well-organized medical department the nurse may be under considerable pressure to exceed her proper rôle. Obviously a nurse's personal qualities, her professional preparation and the type and extent of nursing supervision, together with medically approved written orders, are the greatest safeguards in such situations.

Personal conference between consulting ophthalmologists and nurses in industry is desirable, even where the nurses are under full-time medical direction. Obviously there should be close co-operation between the medical director and the ophthalmologist, but unless the ophthalmologist knows the nursing staff or the supervisor, he cannot adequately appraise the extent of responsibility he can safely and wisely delegate to the nurses. This is greatly facilitated where there is a well-qualified nursing director or supervising nurse with whom he can confer and to whom he can teach the procedures he wishes employed, and who in turn will teach them to her staff. Such guidance should be continuous. It is not enough to set up standing orders, outline and teach procedures. As new problems and methods arise, or situations and personnel change, the way should be open for such additional contacts between the ophthalmologist and the nurse as are needed.

An example of the need for guidance was seen in a plant recently visited. Here a substitute nurse had replaced the previous nurse, who had gone into war service. There were no standing orders for eye care, and the only facilities for the care of eye emergencies were eye-cups, a commercial eye wash, boric acid and butyn, the latter in a dropper bottle.

Nor should the ophthalmologist's guidance be limited to procedures for emergency care. In co-operation with the medical director or plant physician, consideration should be given also to the nurse's place in vision testing, the type of tests to be used, records to be kept, and interpretations to be made by nurses where such are included in her functions. As workers often ask nurses questions not only about their own eye problems but also those of their

families, nurses have tremendous opportunities for public education in eye health and safety. However, here again nurses need help, as their knowledge of this subject is often limited. Written instructions for all of these activities are urgently needed at the present time when so many nurses are entering industrial service for the first time.

Essential to the rendering of eye service is the necessary equipment. Nurses are often unfamiliar with much of this equipment and the sources from which it can be purchased. Nor do they always realize the importance of adequate standardized equipment and facilities. Unfortunately, they often hesitate to ask for the equipment that they need, as they are not sufficiently impressed with the importance of good equipment, and try to get along on much too little. The consulting ophthalmologist should be prepared to advise and assist the nurse or medical director in interpreting to management the fact that it is an economy in the long run to make adequate provisions for eye care, vision testing, and for education about eye health and safety.

If ophthalmologists are to help guide the eye program of nurses in industry, they must develop an over-all view of its place in relation to other aspects of health protection for which these nurses are responsible. It will ill serve sight conservation if, for example, the nurse gives so much time to vision tests or the goggles program that the venereal disease program suffers. Nor should the consulting ophthalmologist encourage nurses to take on responsibilities in relation to eye care which they may be perfectly capable of fulfilling but which more properly lie within the scope of some other department. If such a department is not ready to undertake its full duties in relation to eyes, it should be built up to the point where it can. I am thinking particularly of the goggles program in which the nurse can, of course, co-operate, but the major responsibility for which should rest with the safety department. Equally, in a program for studying the vision of candidates for jobs, although vision testing may be within the scope of the nurse's duties, appraising the nature of visual tasks definitely is not. An enthusiastic nurse, especially in a plant with part-time medical direction and perhaps a limited safety department, often is inclined to take on these responsibilities because she realizes their importance and sees no other way to get them done.

Workers tend to bring many problems to the nurse, especially in small plants. Thus the nurse who receives frequent complaints about poor lighting or so-called "eyestrain" is often tempted to try to make lighting surveys. This too lies outside the nurse's proper scope, although she should be alert to lighting problems in her tours of the plant and should report complaints and faulty conditions to the proper person. Of course, she should know where to get expert advice on this highly technical subject, just as she should be familiar with national, state and local resources for other aspects of eye care.

Here again ophthalmologists can be of great assistance. Many of the nurses coming into industry are not familiar with these resources, either because their previous work has not required such knowledge or because they are new to the community. The ophthalmological consultant should be in a position to help the nurses build up a file of resources for eye care, and for proper equipment.

To sum up, ophthalmologists can and should guide industrial nurses in eye care, and such assistance is urgently needed. This is a challenge both to the individual consultant and to the ophthalmological sections of medical societies which should have a part in developing the standards for industrial health programs and leadership in the standards for eye care in industry. The Standing Orders for Nurses in Industry prepared by the Council on Industrial Health and published in the August 28, 1943 issue of the *Journal* of the American Medical Association is a good beginning. These, however, are limited to emergency procedures. The section on eye injuries, while covering essential points, does not adequately indicate the equipment and specific techniques to be used. Expanding this type of material to define nurses' functions in eye care in industry and to give detailed directions would greatly enhance the co-operation nurses could give in the industrial eye program. Such standards, however, should be largely suggestive, nurses in particular industries receiving direct guidance from the consulting ophthalmologists to whom the workers are referred. While nurses can agitate for such service from ophthalmologists, it is the ophthalmologists themselves, through their organizations and as individuals, who must convince their colleagues, who are industrial physicians, as well as management, that such service is not only highly desirable but essential to the welfare of the workers.

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Prevention of Blindness on the Home Front*

Eleanor Brown Merrill

DISCUSSES status of prevention of blindness movement in United States, based upon questionnaire study of official and voluntary State and local agencies.

TEN years ago, there were comparatively few State programs for the prevention of blindness—according to record in the office of the National Society for Prevention of Blindness, 4 voluntary societies were in existence in 1935, and 8 state-wide publicly supported programs. In 1933, the Society had count of 32 workers specializing in hospital social service with eye patients (full time or a major portion of it) and 8 in community work for prevention of blindness of medical social nature. Formerly we frequently heard, "But, can you prevent blindness?" We seldom meet with this incredulity today, because of a better-educated public.

In preparation for this discussion, questionnaires were sent to 23 official and voluntary State agencies, and to 15 voluntary local agencies. Replies were received from 18 State and 9 local agencies. If it were possible, I should like to see an analysis with evaluation of the activities and functions; this would be helpful to all of us and a stimulating aid to better performance. But no such analysis is available, nor would the National Society have the temerity to pronounce judgment or feel itself to be the proper arbiter. Let me make clear, at the outset, therefore, that this is a report of present organized activities for the prevention of blindness, as given to us by the responding agencies. It must be explained further that the coverage is not complete, both because of failure to receive some returns as mentioned and because we have been able to address only those

* Presented at the National Conference of Social Work, May —, 1944, held in Cleveland, Ohio.

agencies registered with the National Society and may be omitting others of which we are unaware.

States reporting are: Connecticut, District of Columbia (counted as a State), Florida, Illinois, Kansas, Louisiana, Maine, Maryland, Massachusetts, Minnesota, New Hampshire, New Mexico, New York, Ohio, Tennessee, Virginia, Washington, and West Virginia. Local communities are: Grand Rapids, Michigan; St. Louis, Missouri; Passaic County, New Jersey; Brooklyn and New York City; Philadelphia, Pittsburgh, Wilkes-Barre, and Lancaster, Pennsylvania.

Four of the eighteen State organizations are voluntary societies—two of them supported by Community or War Chest funds though other funds are from time to time available for special projects. Of the remaining, two are administered under the Boards of Education; six through bureaus or commissions for the blind under Departments of Social or Public Welfare; one through the Division for the Blind under the Department of Social Security; two through administration of independent Commissions for the Blind; one directly as a program of the Department of Welfare; one as a division of the State Department of Public Assistance; and one through Services for the Blind in a Division of Health and Welfare.

It is noteworthy that wherever direct responsibility for the program may be placed, prevention of blindness services reach out into many—in some cases, practically all—of the branches of State administration and that there is steadily growing understanding of the part which all must play in achieving results. One State, for example, lists channels through which medical care is obtained for eye cases: the Division for the Blind, the Crippled Children's Commission, the Vocational Rehabilitation Division, the Veteran's Administration, the Indian Service of the Department of the Interior, the Family Welfare Association; and coming down into the local administration of State-directed service: the county departments of welfare, the public health nursing associations, the school ophthalmologists—all having a part in this one aspect of the whole.

The cost of medical care for eye cases, is met by the majority of the States reporting for specified groups eligible for eye care; and case work services for certain groups are provided as a part of the program for the blind or through co-operative arrangements between different groups. In Illinois, the Illinois Society for Preven-

tion of Blindness provides consultation services for the medically indigent not receiving relief; for others eligible for eye care responsibility is borne by the official agency concerned. Similar or slightly varying arrangements are in practice elsewhere. An item of interest reported by Illinois under this section of the questionnaire mentions the checking of all birth records, by the Society, and referral of any violations of the law requiring silver nitrate to the Health Department which follows up the case.

In relation to vision testing, fourteen of the eighteen states put more or less emphasis upon the importance of discovering visual difficulties in children through screening and referral of those needing ophthalmological attention. In some instances, responsibility for this service is assumed by Well-Child Clinics of the Health Department so far as preschool children are concerned and by the local Boards of Education for children of school age; in others, main responsibility for both preschool and school children rests with the State and County Health Departments. In the majority, however, it is borne jointly by these two official agencies, always stimulated—sometimes urged—by the organization primarily concerned with conserving vision; in certain instances, these bodies are continuing to point the way with case-finding projects and demonstrations and through the instruction of personnel. In New York State during a twelve-month period the prevention division of the Bureau of Services for the Blind gave 150 demonstrations of vision testing and 60 special instruction periods resulting in a check upon the eyes of approximately 1500 preschool children; but more important is the establishment of what we may hope to be a continuing procedure under local auspices.

Special education for visually handicapped children (generally referred to as sight-saving classes) rests primarily with the educational authorities, agencies for the prevention of blindness taking a leading part in promoting the establishment of sight-saving classes where there is need, and in bringing about special training for the teachers. It is of interest to note that at latest count 620 sight-saving classes are operating in 218 cities representing 31 states, the District of Columbia and Hawaii.

In regard to rehabilitation, practically all the State agencies reported that they have plans which have been approved or are now

under review in Washington. Reports indicate that main responsibility in this area will generally rest with the State Vocational Rehabilitation Division, at least so far as medical care, training, and placement of the partially seeing are concerned. Plans provide for co-operation from the state prevention of blindness agencies through consultation service; and with the public health administration through case finding.

Less emphasis seems to have been put by the state and local organizations on industrial eye health and safety than on other aspects, except as a part of general public education, according to reports. However, with the war bringing special focus upon the problem of industrial accidents, increased co-operation is noted with Divisions of Industrial Hygiene in encouraging and developing sight conservation procedures. Items from the Kansas report call attention to what might be expected from a Division of Industrial Hygiene, sometimes located within the State Board of Health, sometimes within the Department of Labor; the report states:

> The division has a staff which includes a medical doctor, an engineer, a chemist, etc. It makes appraisals in the various plants which include lighting surveys, checking for the presence of dust and gases which are a source of irritation to the eyes. It does not make a planned check of protective devices worn to conserve eyesight, but takes note as it visits the plants and frequently suggests the use of goggles, and of specific types if the style worn is not adequate. It prepares educational material and enlists co-operation of the nurse, foremen, and employees in planning to decrease the incidence of eye hazards.

Though nothing is said here of the medical aspects, there is, through state industrial hygiene programs, opportunity for discovering eye defects and diseases by properly conducted screening and medical examinations; for correction and treatment of eye conditions through ophthalmological guidance and co-operation; for proper placement on the job through understanding of work requirements and the individual's visual limitations; for adequate first aid provisions and regulation with direction of the medical and nursing staff; for education of management and labor in the principles of eye health and safety. There is opportunity to extend that

education by way of the employees back into the home and family group.

Without prodding from agencies concerned especially with eye health, the programs for safety and hygiene in industry will in large measure be general in nature, and ignore many factors which are significant from our standpoint. Here is where several states have entered the picture in undertaking special projects. A program in Illinois for screening, job analysis and safety surveys should provide data and point the way for future action. Study of records from the Workman's Compensation Commission in Kansas gives convincing material for the Division's use with industrial and safety personnel. New York has initiated meetings with the Division of Industrial Hygiene to consider revision of the State Safety Codes in order to provide greater eye protection in industry. With the success of these efforts, other states may be able to add their influence in bringing about better industrial safety practices.

Of the nine local voluntary agencies reporting, the Wilkes-Barre and Pittsburgh branches of the Pennsylvania Association for the Blind mention distribution of educational material in industry as definite projects in this field. Findings of the industrial study of the National Society for the Prevention of Blindness gave the basis for preparation of material and approach to the United States Public Health Service for assistance, who assigned an ophthalmologist to the Society for work in the industrial field; and close working relations were established with the Division of Industrial Hygiene of the Public Health Service.

Late in 1943 a project was begun in co-operation with the Connecticut State Department of Health for the three-fold purpose of obtaining a picture of industrial vision practices in a typical concentrated industrial region engaged largely in war work; trying out various methods of screening tests and procedures for visual examinations; and formulating recommendations for methods of appraising and improving existing visual conditions in industry to serve as a pattern elsewhere.

The Society's *Manual and Appraisal Form on Conservation and Utilization of Eyesight in Industry* has been circulated to some extent and arrangements are under way for an extended mailing to industry through government channels; servicing of returns will in-

clude, according to plans, the follow-up of shortcomings reported with practical recommendations for improvement. It is believed that as a result of steps taken there will be an increasing demand for ophthalmologists. Therefore, with the co-operation of the Joint Committee on Industrial Ophthalmology of the American Academy of Ophthalmology and Otolaryngology and the American Medical Association, the National Society held a Seminar in Industrial Ophthalmology, for which 99 ophthalmologists registered. It may be an introductory step with other similar or more thorough courses to follow; we are not able to say at the moment.

On looking through the reporting from both state and local sources it is interesting to see the number and variety of special projects that have been undertaken. New Hampshire has developed a special eye record form for use in examining applicants for driver's licenses. New York has established an orthoptic center in an up-state city by the loan of a technician for demonstration purposes and enlistment of local support. Illinois has undertaken a joint demonstration with Cook County Bureau of Public Welfare in restoring sight to those on the blind pension list. Kansas has instituted a program of follow-up of men rejected for military service which includes medical care to those eligible and referral to the division of vocational rehabilitation. New York, with local co-operation, has conducted certain studies in the incidence of new blindness and in the treatment of ophthalmia neonatorum and trachoma cases. Louisiana and Maryland have undertaken special studies of registers of the blind to determine causes. Maine, Illinois, Lancaster (Pennsylvania), Brooklyn (New York), and Tennessee all report intensive projects in relation to the development and strengthening of sight-saving classes; Washington mentions a program to stimulate the use of sight-saving material by teachers having visually handicapped children in regular classes and by teachers' colleges. Maryland has engaged in a study of cases given glasses over a two-year period and in a joint project with the Lions Clubs leading to better eye care for children in institutions. Massachusetts, Minnesota, New York, Grand Rapids, St. Louis, Passaic County (New Jersey), have intensified their efforts to correct faulty school eye health conditions; in similar efforts Louisiana and Wilkes-Barre have made special lighting surveys and planned lighting exhibits.

Florida has a project to bring about improved lighting in homes and industry. Washington reports participation with the State Department of Health and the Office of Indian Affairs in a trachoma case-finding and control program. In the District of Columbia plans have been worked out for organizing and carrying a demonstration glaucoma clinic in a leading eye hospital; Minnesota has concentrated on a glaucoma educational program with education of the general practitioner; Philadelphia has developed a program for following up glaucoma patients treated in eleven of the eye clinics, carrying instructions to patients and assuring continued treatment.

The National Society's Committee on Glaucoma was formed, composed of ophthalmological heads of eye services in New York City and representatives from the United Hospital Fund, hospital administrations and the Bureau of Services for the blind. Projects were undertaken in New York City with the object of obtaining better control over glaucoma cases handled in the various eye clinics and demonstrating desirable techniques to be followed in order to discover cases in their earliest stages. The program has included training and use of volunteer assistants for charting fields of vision, taking visions and tensions, developing a file of glaucoma patients, and for other clinical details.

Some other projects with which the National Society has been concerned during the past two years are a study of nursing curricula to bring about increased attention to eyes in the preparation of nurses; continued study of vision-testing techniques; continued sponsoring of training for medical social eye workers (in this connection I'd like to note the training at Washington University last winter of two young women from São Paulo, Brazil, through financial assistance from the Coordinator of Inter-American Affairs); continued sponsorship of training for sight-saving class teachers and publication of the handbook *Education and Health of the Partially Seeing Child;* studies of the schools for the blind in two states with a view to restoration of vision and educational adjustment for the children with sight. This project is a joint one with the American Foundation for the Blind which is considering the problems within its area.

There is expansion in educational activities on all sides as well as broadening co-operation and support, both lay and professional,

judging from the reports. As a liaison agency among official and voluntary national and local groups the National Society carries on an educational program through publications, films, radio broadcasts, lectures, institutes, summer courses, exhibits, conferences, and correspondence. Twenty state medical societies now have conservation of vision committees—a significant contribution to prevention of blindness and one about which I should like to comment further if time allowed.

But let us not be blind to the problems ahead! In response to questionnaires, attention is called to a recognized increase in venereal disease. Special alertness seems called for if a rise in blindness from ophthalmia neonatorum is to be avoided. We have record of increase in industrial eye accidents. Keratoconjunctivitis is reported to have broken out in a number of communities. The danger of increase in various eye infections with return to this country from Europe of our military and civilian forces cannot be overlooked. Eye injuries resulting from the war may make heavy demand upon our resources. Decrease in the number of available eye physicians is serious and there is shortage of other personnel.

These are some of the problems we have to face in the coming months calling for all the strength and ingenuity at our command. But with experience and greater knowledge workers in the prevention of blindness field are able as never before to "preach the gospel" and influence future conditions.

Facing The Cataract Problem

Jack P. Cowen, M.D.

DESCRIBES development of cataract; medical care; when operation is indicated; postoperative care and prospects.

Place of the Cataract in the Life Physiology of the Individual

The onset of cataract in the older individual (and for the present discussion, the subject shall confine itself to the older people) is considered to be the beginning of the end, a disastrous occurrence that spells the onset of blindness. It is considered a dreaded affliction or disease that visits the old, like cancer and diabetes. In some respects, it is a degenerative condition, but should be really considered no more abnormal than the graying of the hair, to which it bears more than superficial resemblance. It is true that the portion of the eye involved has undergone a type of death or disintegration, but this is no more the death of the entire visual organ than graying of the hair means the loss of the hair.

Nature of the Cataract

To most individuals, "cataract" implies anything which clouds the vision, or which is visible as a gray membrane or veil over the cornea, pupil or lid, for that matter. Before we proceed, it would be wise to consider just what is meant by a cataract. A cataract is an opacification of the lens of the eye, so that this focusing structure suffers an impairment of its translucency, and hence distorts the light entering the eye and disturbs vision.

In examining the diagram, we see represented the opening of the camera, which is analogous to the cornea and pupil of the eye. Behind this is a focusing mechanism, a lens, which does the same job as the crystalline lens within the eye. Behind this is the sensitive plate upon which the focused image is thrown. This is analogous to the retina in the human eye. A cataract is a graying or opacity

of this lens, and nothing more. It is a process which occurs slowly, casting its shadow long before it is complete. It is clear that an opacification of the lens in our diagram would effectively blur or block the sight unless something were done to remove it and replace it by a focusing device of equivalent refractive strength. The term

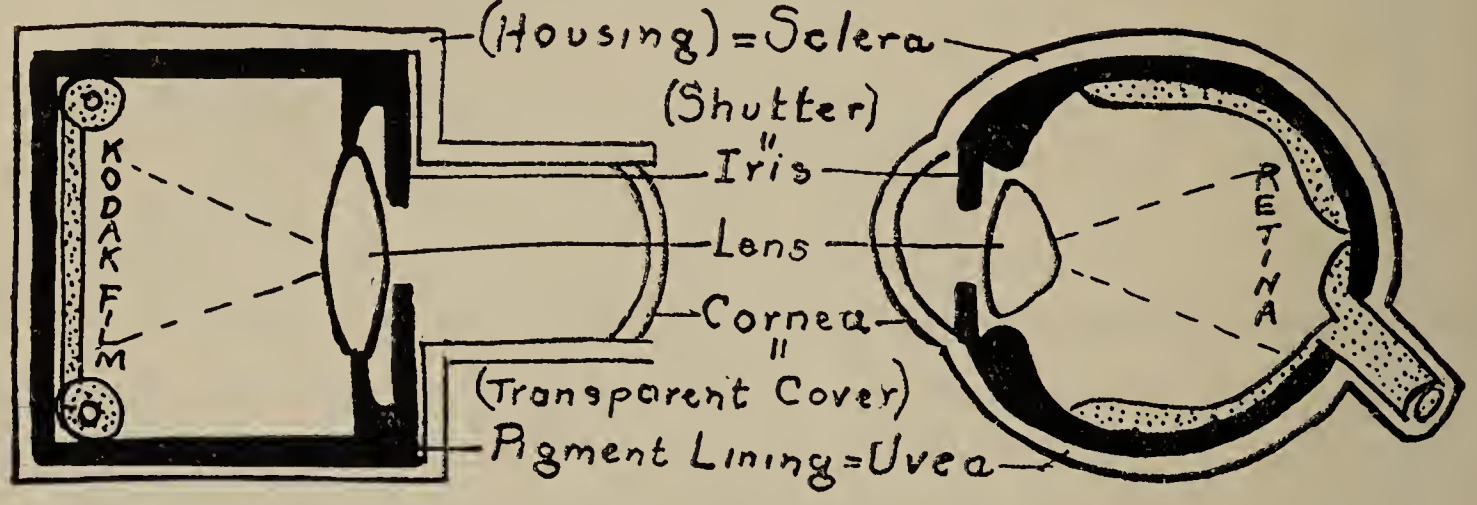

FIGURE 1.—ANALOGOUS STUDY OF THE DIAGRAMMATIC HUMAN EYE WITH THE PHOTOGRAPHIC CAMERA, IN CROSS SECTION

"cataract" is sometimes erroneously used to imply loss of vision when the blame should be laid elsewhere, when whatever lens opacity is present is only minor, or may actually be present as a complication to the real cause of the blindness. Thus, we might conceive of a case in which a tiny bullet has passed through the eyeball, causing blindness by destroying the nerve but causing incidentally a cataract by having damaged the lens on its passage through the eye.

Types of Cataracts

For the sake of completeness, we should discuss the most prominent types of cataracts, irrespective of the age-groups which are affected. The earliest types are those affecting infants and children, called "congenital cataracts." These congenital cataracts are usually present at birth and bespeak an injury or disturbance to the young lens tissue, the cause of which frequently harks back to the period in the infant's intrauterine life.

From the position of the opacities within the lens, the exact period of the infant's life in which the opacity developed can be determined. The lens is a living tissue with a life-history and growth all its own. This growth is from the center or nucleus out-

ward in layers, like an onion-skin; this continues throughout life, so that the lens is constantly enlarging, hiding deeper in its middle, the history of its past. At any time, then, the doctor can determine at about which period the opacity has developed, by noting the stratum or layer in which it is located. Certain types of these cataracts occurring at birth are found to be present in both eyes. They seem to have been formed in the third to the seventh fetal months, and are found in whole families, inherited in a dominant fashion. Disturbance of nutrition and rickets undoubtedly play a large rôle in these cases, as can be substantiated by examining the patient's first teeth.

A word might be said concerning the treatment of these cases. The diminution of vision, of course, depends upon the density of the opacity and the amount of obstruction and distortion to the incoming light. The rough rule as indication for surgical treatment in cases of congenital cataract with poor corrected vision bilaterally is as follows: if the binocular corrected vision can be improved to 20/30 through widened pupils (which permits the light largely to pass around the lens opacity), a permanent surgical enlargement of the pupillary opening should be considered. However, when the pupils are enlarged and the vision binocularly cannot be brought up to 20/40 with correction, then useful vision will be hard to obtain without surgical removal of the affected lens. The glass lens put into the frame before the eyes after operation will supply the light-focussing power of the opaque lens removed from the affected eye.

Senile Cataract

The senile cataract is one of chief interest in this study, and will be taken up in detail later. Briefly, it puts in its appearance around the forty-fifth year, or later, becoming increasingly more frequent in the older age groups. In some families, cataracts appear very early, as does gray hair; in others, it seems never to appear.

Complicated Cataract

As has been outlined before, cataracts can occur at any time, as result of some injury or disturbance to the lens, or to the surrounding ocular tissues. Of those which produce a direct mechanical

injury to the lens, lightning, sunstroke, glass-blowing and steel puddling might be mentioned. Blunt blows or penetrating injuries are direct causes. Materials taken by mouth, as di-nitro-phenol, taken for weight-reducing, have been incriminated. Diseases and conditions which affect the nutrition of the lens, as tetany and diabetes, or those which produce prolonged disease within the eye, as iritis, glaucoma, retinitis pigmentosa, or detachment of the retina may be responsible. In case a cataract forms, it will be seen how the initial ocular disease may be hidden.

Symptoms of Senile Cataract

The first symptoms of a cataract depend somewhat on the position of the opacity in the lens. The most troublesome opacities are central because they first produce a blurring of the distant vision. They are most troublesome when the pupil contracts, forcing the light to traverse through them; hence they produce considerable trouble when the patient tries to read or when he goes into bright daylight or artificial light. In both of these instances, the pupil involuntarily contracts, cutting off all clear rays that might pass around the cataract. At this time, patients are apt to report that "rays" or "dazzling stars" emanate from lights. Objects may ap-

Distortion of Light Rays passing through the Cataractous Portion of the Lens.

Distortion avoided by the Shutter-like Action of the Iris.

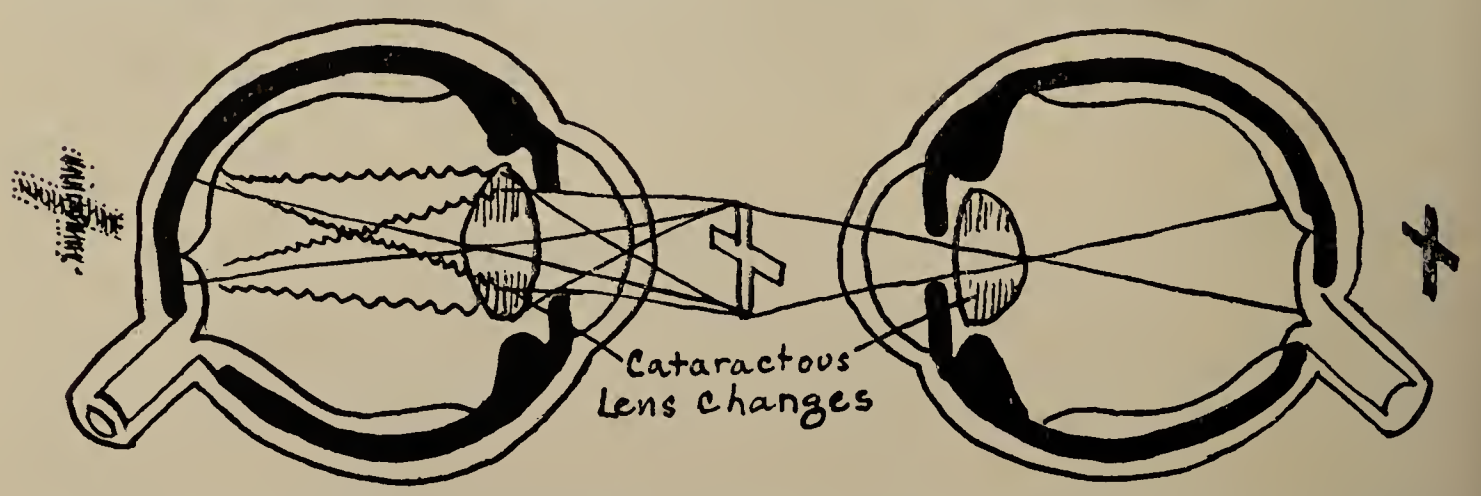

FIGURE 2.—DIAGRAM OF THE EFFECT OF THE CONTRACTION AND DILATION OF THE PUPIL ON PERIPHERALLY-LOCATED OPACITIES OF THE LENS

pear doubled through one eye, or may have colored rings around them. The patient may see the cataract as a "floater," or shadows.

These findings are most quickly picked up if they occur in the patient's master or dominant eye; in the non-dominant eye, the

cataract formation may be so completely unnoticed that discovery that the eye is rendering no service comes as a complete surprise; this, of course, assumes that the mate eye has satisfactory vision.

In contrast to the central lens opacity, an eccentric or peripherally-placed opacity, as illustrated above, disturbs the patient most at twilight or in the movies. Patients state that they are helpless "after five o'clock at night," until the street-lights go on. They sometimes squint their lids to shut out the light that passes through the distorting portion of the lens. This effort produces headache and strain, although these latter symptoms are rare in cataract patients.

Signs of Cataract

After the age of sixty, very little change in glasses is necessary unless there is a disturbance in the refracting system, such as cataract formation. Glasses then suddenly "become too weak or too strong." The latter phenomenon is popularly called "second vision," and the patient is then able to discard his glasses and may read without them. The actual appearance of the cataract, as a graying of the pupil, may be seen, although the opacity that causes the greatest disturbance of vision is one that occurs in the back part of the lens, not easily seen externally; as a matter of fact, the apparent denseness of the cataract from a casual outside look is no criterion of the vision that the patient may have through this eye. Only careful study by the eye physician to see whether the cataract is the real cause of the visual disturbance should settle this matter.

Effect of the Developing Cataract on the Patient

Because of the popular conceptions of cataract, mentioned at the beginning of this discussion, the discovery that a cataract is present, even though it gives no symptoms, is usually a matter of serious concern to the patient. Of course, it is no light matter, although it is not nearly so fraught with perils as the patient is likely to believe. If the cataract is small, out of the line of vision, and if the mate eye can be brought to good vision, with suitable correction, it is unnecessary to burden the patient with the name "cataract." In the first place, the opacity may remain in a stationary condition for many years. It is preferable to refer to it as an "opacity of the lens" and keep it under regular observation and correction.

The knowledge that a cataract is present may cause the patient to become worried about going blind, operation, and so forth. The fear of blindness or of operation might drive the patient into the hands of quacks and charlatans who will milk him of his last cent for eyedrops and medicines to "dissolve the cataracts." It would be as logical to try to dissolve the gray out of gray hair. At present, medical and immunological treatment of lens opacities has proven to be of no definite scientific value, and hence is not considered.

Duty of the Physician to the Cataractous Patient

The most important immediate duty of the physician is that of reassurance that the process is a normal occurrence in advancing age; that the underlying nerve structure of the eye is in perfect condition; and that the patient's visual efficiency will be maintained at its highest level. The patient must also be made to realize his visual limitations, so that he does not attempt such hazardous occupations as driving an automobile, particularly around dusk, or crossing streets against a dazzling sun.

The Time for Surgery

Assuming that the patient comes to the physician regularly, when should the operation be advised? The rule of choice is this: operation is recommended when the better seeing of the two eyes is no longer capable of serving the patient's ordinary needs. Or one hears this rule: remove the cataract when the patient is no longer happy. The practice of waiting until the cataract is "completely ripe" is definitely a thing of the past; newer methods of cataract extraction have been devised to permit operation at almost any time. However, when a cataract comes to ripening or maturity, even though the mate eye still has good vision, surgery is recommended. Permitting a mature cataract to go unoperated leads to hypermaturity, a state in which surgery is more difficult and in which complications may present themselves which may imperil the health of the eye. When only one eye is operated upon, the patient must be forewarned that a state of rivalry will exist between the operated and non-operated eyes, and that glasses cannot be given to correct both of them at once. The better eye will be corrected

with glasses, and the mate eye will assume a subordinate position. If the patient prefers to use the operated eye, the unoperated or "spare eye" may be given its own correction in another frame to use at intervals, as a "matter of practice." He may be assured that the two eyes, when both have been operated upon, will work well together again.

Preoperative Management

Usual medical procedure would be to determine whether one is dealing with a normal eye under the cataract, whether it has the requisite ability to perceive and project light and colors. The doctor will look for evidence of former ocular disease. He will make a thorough-going test for general disease, or see that this is adequately investigated by the patient's general physician. Abscessed teeth and other possible foci of infection must be ferreted out. Careful inventories of the heart and pulmonary systems should be studied; it must be remembered that the patient must lie supine for several days, and shortness of breath or severe coughing may make this impossible. Careful study of the urinary tract and urinalysis may uncover an unsuspected diabetes or an impending urinary obstruction, which might severely upset the convalescent period. Cleanliness and health of the eye itself under consideration, is of paramount importance, and will be carefully watched by the conscientious ophthalmologist.

Surgical Procedure and Management

The patient is hospitalized one or two days before the operation to accustom him to the institution, to try out sedatives, and to insure adequate rest and preoperative treatment. The patient will plan to remain in the hospital for ten to fourteen days. The operation itself is performed under local anesthesia, the patient feeling little beyond the tiny needle-prick under the skin to secure anesthesia. Of course, the patient is adequately quieted by suitable sedatives to "take the edge off" his nervousness and apprehension; many patients wake up the next day and inquire when the operation is to occur, although they may have talked and co-operated nicely during the surgery the day before.

Postoperative Considerations

After hospital discharge, the patient takes it decidedly "easy" at home, and on the doctor's instruction, the patient makes regular office visits, at which times lenses are tried to improve the vision of the operated eye. Such a lens, if satisfactory, can be given as a temporary glass; the patient is ready for this within three to eight weeks, depending on the clearness of the eye and the type of operation performed. When the vision has reached its maximum, a permanent glass is ordered, with an appropriate correction for reading, worn either as a bifocal glass, or as a slip-over lens to focus for the reading range. Usually by this time, about eight weeks, the patient is ready to return to work.

In certain cases following surgery, complications may arise. The most common of these is secondary cataract, a fine web-like membrane which covers the pupillary space. This sufficiently obstructs the vision so that it has to be swept out of the way by a surgical maneuver known as "needling." This requires only a short period of hospitalization, and usually only one needling is necessary to eradicate this membrane. Other complications which may occur post-operatively in the order of their frequency are: hemorrhage, opening of the wound with prolapse of the iris, iritis, secondary glaucoma, and intra-ocular infection.

Outlook for the Operative Patient

Notwithstanding these possible complications, the cataract patient still has the following outlook from a statistical standpoint. Birch-Hirschfeld, drawing the statistics from the files of several thousand unselected clinic cases in one of the large European clinics, found the following results in his operated cataract cases: 93 per cent and up had vision of 20/60 or better; 75 per cent had vision between 20/20 and 20/40; and 50 per cent had perfect vision of 20/20.

Thus cataract, the mental and visual hazard, is reduced by careful study and medical treatment to a condition which can be successfully combatted, so that, after management, the patient is returned to the visual efficiency that he enjoyed thirty years before.

The Eye Problem and Health Education*

Lula P. Dilworth, R.N.

DISCUSSES environmental, hygienic, and medical aspects of school eye health.

THE promotion of eye health is an integral part of the long range objective of education—preparation for a full and satisfactory type of living—personal, vocational and community.

Until recently there has been a tendency for school eye health programs to be concerned chiefly with discovering defects and attempting to have them treated. While this is an essential feature of the work, it is but one segment of the whole. And unfortunately it is the accidental or negative one. As a positive consideration we are challenged to create for every child a school situation which first, will preserve that which is good, and second, will be conducive to uninterrupted, normal growth and development.

The Eye in Education

We have no known means of determining the extent of damage which has resulted solely from extensive use of normal eyes for close work in the school setting. Be that as it may, with the knowledge now available continued exposure of this type is not alone unfair but also unintelligent.

Dr. Charles Sheard of the Mayo Clinic has stated that one-fourth of bodily energy goes into the process of seeing. If there is an eye difficulty, if the light is not correct from the viewpoints of quantity and quality, or if the eye task is too difficult for the eye to perform (poor print, improper writing, poor paper, lack of contrast, lack of correct spacing, etc.), under such conditions the

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amount of energy needed to fulfill the eye task is even greater, and, it must be supplied at the expense of some other bodily function.

It is a trite but true statement that our present day school curricula require a very great amount of eye use. This is true, not only during school hours, but, on the junior and especially high school level, much additional eye use is required for homework.

Scientific studies have demonstrated that there are conditions under which both the normal and impaired eye function with maximum efficiency, speed, and comfort. As educators and health workers, we must see that these favorable conditions prevail throughout the school experience, and provide instruction in ways of incorporating these same principles in the home setting and anywhere else, where close eye work is required. This prompts the thesis that eye health is an essential consideration in the over-all planning for the welfare of pupils. It is a concern of each member of the school staff, in every part of the building, and, in relation to each individual child.

Among the factors which operate in a comprehensive plan for efficient and economical use of eye power during the developmental years are the environment, materials and equipment, habits of study or work, knowledge of individual capacities, treatment or correction of defects, special education for pupils with serious defects, and last but of great significance, general health with special emphasis upon nutrition. Recently a noted ophthalmologist told of having seen some half-starved refugee children. He declined to do anything about their eyes until they had had treatment for other physical deficiencies. After good routine care, over a period of time, the need for eye treatment had disappeared entirely.

Going back to the environment, we are faced with the fact that children are compelled to spend a considerable portion of their time in the school setting and therefore it should be safe and hygienic. Factors which bear a definite relationship to eye health are lighting, seating, proper materials and equipment.

Lighting

Correct lighting results when light is (1) adequate in amount—15 foot-candles preferred; (2) properly distributed; (3) properly

diffused and controlled (used when needed); and (4) properly directed (has proper contrasts, and glare is absent).

What is glare and what are its effects? Glare is the unequal stimulation of different parts of the retina by light. When all parts of the visual field are equally stimulated glare is absent. Bright rays of light striking the retina tend to set up a local irritation of the retina. When there is an unequal stimulation of the retina the part receiving the least stimulation experiences a depression of vision. The greater the contrast between the two stimuli the greater the depression of vision in the less stimulated part.

Illumination should be back of the shoulder line of the arm opposite the one the pupil uses in writing.

Considerable progress has been made in lighting schools recently. Walls and ceilings are being finished or refinished in colors having a high reflection factor. An analysis of our own situation will reveal whether our rating is good or falls within a grouping described by Dr. Abel Wollman of Johns Hopkins University as the worst example of lighting within the community.

School Seating

Even with all details of lighting properly provided, poor eye hygiene can be experienced if seating arrangements are incorrect. Accepted standards for seating include: (1) seats adjusted to the growth of the child; (2) desks (of the most desirable type) that can be adjusted to an angle for correct placement of material in regard to eye work (the light which falls on this sheet when held at right angles with my line of vision is increased up to 70 per cent); (3) placement of seats so that they are at about a 30 degree angle away from the window (this prevents glare from the skyline); (4) placement of the teacher's desk in a darker portion of the room so as to leave the best lighted part for pupils; and (5) placement of pupils with eye defects in relation to illumination which will give them the greatest eye comfort.

Some individuals cannot tolerate more than ten foot-candles of light; however, the average person works more efficiently with 15 foot-candles.

Better seating arrangements are noted in many schools but far too many pupils, especially younger ones, are continuing to be ex-

posed to glare from facing windows or other uneven intensities or streaks of light.

Vision Testing

After having determined that the school is a suitable place in which to have children engage in close eye work, the next step is to get an idea of the effectiveness of the mechanism for eye work with which each child is equipped. Since the organ of sight is the chief means of learning, the purposes of education will be defeated at the outset if this pathway is obstructed, and this fact goes unrecognized by the teacher.

Unfortunately screening tests and observations, rather than complete eye examinations are, and for some time must be, our chief means of determining whether visual acuity is normal or otherwise. However, studies have shown that the simple Snellen type test for visual acuity, together with significant observations as reported by teacher, nurse or parent, when compared with the diagnoses of ophthalmologists were more reliable than were two other types of tests studied. This method alone will reveal more needs than ordinarily can be met.

In Massachusetts the Snellen type test, a Maddox rod test and a plus 1.50 sphere test are used. When a pupil fails on the first test the other two are omitted. Of all pupils referred, 86 per cent were found by using the Snellen test; 7 per cent more were discovered by the plus 1.50 sphere test.

The significance of testing visual acuity early in the school experience, preferably in the preschool period, cannot be overemphasized. A complete ophthalmological examination at this time would be economical from the viewpoint of education, health conservation, and vocational interest. Weaknesses in muscle balance—squint—should be recognized and treated at an early age. Excessive hyperopia, if discovered early, often can be brought to normal. Myopia frequently has its onset during the elementary school years, and prompt discovery and treatment can be accomplished only through careful observations and testing.

With proper training, the technique of making screening tests can be mastered by a non-medically trained person. For psychological, as well as health reasons, many teachers are eager to

administer tests to their own pupils. The important consideration is that in each school some good plan be adopted whereby each pupil will have, as a minimum, one screening test a year and that one early in the school year. Changes and accidents do occur during vacation periods of which pupil and parent may both be unaware.

Treatment for Eye Conditions

It should be known that glasses are not a cure-all for eye defects nor, conversely, that the presence of defective vision is in itself an indication of the need for glasses. Among the more serious eye conditions among children, *i. e.* those leading to blindness, refractive errors constitute only 5 per cent—these are chiefly myopes with pathological complications.

Glasses sometimes are used in conjunction with other treatment —after surgery for cataract, or as a part of treatment for correction of squint—but orthoptic training and surgery also may be involved.

To be effective, treatment of eye conditions other than simple error of refraction must be directed at the cause. Important causes are: communicable and other systemic disease, nutritional deficiency, trauma, and prenatal factors, including heredity. These provide clues for follow-up work when pupils return to school following a serious illness or communicable disease. Some authorities require a screening test of vision following each head injury or eye accident.

Another common impression is that the test of visual acuity gives the final answer as to the absence or presence of eyestrain. This also is fallacious. Appearance of the eyes, signs suggesting strain or discomfort, and the child's personal or family history may be more important clues to children requiring follow-up than results of vision tests. A few years ago an eye doctor at the Ford clinic in Detroit said that not one of the children he had seen who had a serious defect of vision would have been overlooked for referral had obvious signs been noted and reported even without a test of vision. On the other hand, a number of individuals who can read the 20 foot line or better at a distance of 20 feet have refractive errors of vision. So we have no sinecure upon which to rely. Tests, history, observations, all together help to tell the story.

It is re-emphasized that the eye is a part of the body, having similar membranes, blood vessels, nerves, etc. It is affected by anything affecting general health and often gives the first clue to disturbances elsewhere in the body, such as malnutrition, focal infections, brain tumors, diabetes or other maladies. Early diagnosis and treatment are essential to prevent severe defects which otherwise may result. Diagnosis and prognosis are infinitely more important than the present degree of vision in determining urgency of treatment. Guides, in general, for referral to physician, recently suggested, are (1) signs of suffering; (2) markedly reduced vision or decreasing vision; and (3) difficulty in reading or other school problems.

Nor does our interest in follow-up end with the one person who has been selected for study. Attention should be directed toward other members of the family in eye conditions caused by syphilis, heredity, or nutritional deficiency.

After a child has received treatment, effective follow-up by the school should include securing from the ophthalmologist information on diagnosis, treatment, and recommendations, e.g., whether glasses are needed, when they are to be worn, what other treatment has been prescribed, restrictions on eye use or the type of special education which is to be provided, and the suggested date for next examinations.

Recommendations

Specific recommendations in carrying out a school eye program are:

1. An exchange of record forms between the school and the ophthalmologist. This presupposes that accurate records of school eye tests of each pupil are kept.

2. Informing physicians of the objectives of the school health procedures and the adjustments the school is in a position to make in educational processes for the child who requires this. These include those for general and vocational education.

3. In certain cases direct, personal conferences between the examiner and appropriate member of the school staff aid in understanding better the child's needs. In all instances the school carries

a continued responsibility to report to the examiner new or continued signs, and indications of improvement.

As an integral part of educational planning, eye health merits careful study. Co-ordinated effort may well be directed toward establishing a wholesome environment, employment of appropriate means of appraising eye health, incorporating sound instruction on eye health in the curriculum, providing special education for pupils with limited sight, employing suitable follow-up measures for treatment of pupils who have eye difficulties, giving suitable vocational counseling in relation to individual ability, and sharing or stimulating interest in the establishment of adequate community resources for promoting eye health for all age levels.

So much can be accomplished in this area of health conservation which will be reflected in more abundant health efficiency and happiness, that all potentialities should be developed in each of our schools as fully as circumstances will permit.

The Relation of Vision Testing to Safety in Industry*

Joseph Lo-Presti, M.D.

PRESENTS some important facts on industrial vision testing; relation of depth perception, color discrimination, muscle imbalance, speed of vision, and age to the job.

Introduction

Vision testing, when carried out in any form, is essentially a highly technical procedure. Analysis and interpretation of information obtained by such methods are even more technical and difficult to follow through. However, we know that the safety engineer or supervisor in his work is interested in applying all types of employee and job data to promote safety. I should therefore like to present today a discussion of the various processes involved in seeing, ways of testing and classifying these, so that their relation to safety is clearly indicated. It should be stressed that this field, industrial vision, is still in a developmental stage. Co-operation among all those involved—the industrial hygienist and the industrial safety man, in particular—is absolutely a prerequisite to the advancement of this development to the stage when we shall be able to make the job safe for vision, and vision both adequate and safe for the job.

Very few physical findings in employee examinations are more important to the safety-minded investigator than those pertaining to eyes. This statement seems to be a sound one until it is challenged—that is, when specific figures, data, and controlled studies are requested. Whenever such detailed information is sought, those of us engaged in industrial eye hygiene are able to cite this or that particular incident or accident, and we usually finish our argument

* Based on papers presented at the West Virginia State-wide Safety Conference, March 24, 1944, and the Greater New York Safety Convention, March 30, 1944.

by appealing to the inquirer's reason, common sense, etc., along some such lines as: "After all, ninety per cent of what we learn and do throughout our lives depends directly or indirectly upon vision. Therefore, visual skills and seeing conditions must play an overwhelmingly important rôle in the number and type of industrial accidents occurring."

The skeptic, however, is not satisfied with such generalities. He might ask, for example, "Just what per cent of industrial accidents are due in whole or in part, directly or indirectly, to poor visual acuity (keenness of vision), to lack of depth perception, to color-discrimination deficiency, to muscle imbalance, as these are measured for distance and near situations, to improper seeing conditions, *i. e.* quality and quantity of illumination?" Our answers to such questions can only be sketchy, incomplete, and qualified at present.

How We See

I should like to discuss separately the various component parts of the visual act and to point out some of their possible implications in the industrial field. It is hoped that such implications will suggest to safety engineers and supervisors the more obvious problems in vision and industrial safety, and also what part they themselves must play to help us find answers to these questions.

Visual acuity—or keenness or sharpness of vision—refers to the ability to perceive form, shape, configuration visually; and essentially, this depends upon the ability to distinguish two points as being separate. The variables industrially significant, which affect this function, are distance and age. Some individuals can see distant *and* near objects clearly; others can see only distant objects clearly, and still others can see only near objects clearly.

Vision Testing at Work Distances

For testing distance vision, a test chart with appropriate letters, numbers, or other symbols, is placed twenty feet from the subject, who has one eye covered at a time. In testing near visual acuity, a small reading card at sixteen to fourteen inches from the subject's eyes, is generally used. Both these testing situations are artificial in so far as workers are concerned; workers as a rule do not use either eye alone, nor only at the distances described. They usually

perform binocularly and at either varying distances or mostly at a relatively fixed working distance. Visual acuity, when measured in individuals selected at random as they apply for jobs, with or without glasses, may vary greatly at different distances. Therefore, it is often the case that the employer never finds out exactly how acute his employees' vision is for the distance at which these men are hired to work. For example, a prospective employee (who is fifty years of age) has a pair of glasses for reading, which means correction has been furnished for normal reading distance of fourteen to sixteen inches. His distance and reading visual acuity is then measured and recorded in each eye, singly; but the man is put on a job, the work distance of which is thirty to forty inches and which requires the use of both eyes simultaneously.

Industry's Responsibility in Vision Testing

Instances like this one, multiplied many times, yield results which, when lumped together, may distort any analysis of job performance, safety, and visual acuity. It is the responsibility of the professional services to provide correction lenses, prisms, exercises, etc., for the work distance; and to measure acuity specifically for the employee's particular job. But it is industry's responsibility to take this factor into account when conducting surveys and making analyses of safety and of visual acuity. It is also industry's responsibility to indicate the work distance in all reports of accidents as they occur, and if possible, the acuity at this distance, if it be available. Only when such data are obtainable can any reasonable deductions be made on a quantitative basis, regarding the possible relationship between accident frequency, or rate, accident repeaters, accident proneness, and visual acuity.

Age and Visual Acuity

It was stated previously that age, too, is a factor in visual acuity. This is so primarily because the ability to do close work diminishes with age—particularly after forty years. It is this limitation imposed by age, that makes it necessary to determine specifically, the acuity or keenness of vision of these older individuals at the particular work distance at which they are working. Just as

flexibility of other functions declines with age, so do visual skills—especially sharpness of vision. For this reason, it is advisable in industry to recheck at more frequent intervals the eyes of employees over forty years of age. This serves not only industry by correcting the vision of aging eyes so that they can continue on the job, but the aging employee, himself, through discovery of other findings, defects, and possible diseases.

To summarize, visual acuity should be measured under those conditions which will yield data that can be expected to correlate most accurately with job performance. That means that acuity at the work distance, using both eyes together, should be recorded and that this should be checked and rechecked at fairly frequent periods in employees over forty years of age. As you may well know, this has not been done in the past. It is well to keep this fact in mind when investigators point out to us that some particular analysis or study of visual acuity—as these are ordinarily measured—does not correlate significantly with either job performance or accident frequency. It may well be that such a correlation, when established along the rigid lines indicated, will not be very great. In fact, it might not even be present at all. However, there is no justification for any such conclusion until the data upon which we base this conclusion have been accurately obtained.

Depth Perception

The second visual skill that was mentioned was depth perception or stereopsis. There exists at present some disagreement as to the actual rôle this visual skill plays, either in job performance or accident rate. This is to be expected because of the following factors:

(1) Some relationship has been demonstrated by the type of work and activities that people ordinarily engage in and the amount of stereopsis found among them—that is, those who do flat work as a rule do not score as high on most tests for depth perception as do individuals who work in depth (those who work on moving equipment, doing assembly work, etc.).

(2) Depth perception has been found to vary with age, independent of the worker involved. Thus, it reaches a maximum between the ages of thirty and fifty; and is lower than this level below the age of thirty and over the age of fifty.

(3) There is also some evidence that depth perception can be developed to some degree by training. However, most tests to measure the ability of individuals to distinguish the distance of various objects in relation to one another, are extremely difficult to devise, administer, and interpret. Most industrial medical offices, where physical examinations are done, are not equipped with devices to measure depth qualitatively, let alone quantitatively.

The majority of American workers are hired without any attempt to determine whether or not they do see in three dimensions, and yet it would be very dangerous to assign a man who does not have the sense of depth appreciation which is needed to operate a crane or to run any mobile equipment, where split-second decisions as to position of objects have to be made. As was just pointed out, learning plays a big part in the carrying out of such operations. This factor makes it very difficult to evaluate the full importance and significance of depth perception in industry. Again, just as for visual acuity, before we shall be able to say what percentage of industrial accidents are due to faulty depth perception, we shall have to wait until depth perception is measured accurately, and in a large enough number of workers.

Color Discrimination

The third visual skill that I should like to consider is color discrimination. The implications of this aspect of visual skills, with respect to safety, seem more apparent than those in the two aspects previously considered—visual acuity and depth perception. We are all familiar with the various signal devices used for directing traffic and with the color schemes employed in wiring codes. It is obvious that an individual who is unable to distinguish red from green (green color blindness) is likely to misinterpret safety signals. Yet there are far too many instances where color vision tests are not conducted. One of the simplest things that can be done by a safety supervisor in any plant, which will yield profitable results in cutting down accidents, is to undertake a complete color vision survey of employees in the plant—all those engaged directly or indirectly with operations where colored signal devices are used. It is recommended, however, that a survey of this type should employ one of several approved tests. There are available for this purpose very

satisfactory color plates, which may be obtained from any one of the large optical companies in this country. Too often, so-called simplified tests are used. Because of deficiencies in their make-up, their use should definitely be discouraged when more adequate means are available.

In a study of some 7,000 subjects, red and green color discrimination was measured and plotted against age (from twenty to seventy years). The percentage of those passing the test declined markedly with age. I should again like to suggest that individuals over forty, engaged in processes where color discrimination is important, should be tested at frequent intervals.

Muscle Imbalance

The fourth aspect of visual skills, muscle imbalance, has been shown, in one study, to be of extreme significance. It was found that on the average, some nine per cent of serious accidents occurred among individuals who had faulty (that is, insufficient) convergence, and that only four per cent of individuals who had adequate convergence ability, suffered serious accidents in this same plant of several thousand workers.

By convergence is meant the ability of an individual to direct both eyes properly to the object viewed, so that the eyes are in proper alignment for the distance at which the object is located.

It is surprising again to learn how few are the industrial establishments which attempt to attain some measure of muscle balance. However, there is some justification for this oversight, inasmuch as the test of ocular muscle balance is a complicated and time-consuming process. Nevertheless, the remarkable study just mentioned in connection with the red-green color discrimination testing, should stimulate further surveys of this type.

I do hope that by this time it has become apparent that, in attempting to uncover the important relationship existing between vision and industry, the various visual factors have to be separately considered. It is not enough to determine the smallest letter or number that an employee is able to see at a twenty-foot distance. It is also highly important to know what his muscle balance is, what degree of depth perception he has, whether he has color dis-

crimination at his usual work distance—or better, at the distance involved when the accident occurred.

Speed of Vision

One other item, not previously mentioned, is the speed of vision —that is, how long an individual's eyes must be exposed to a particular object before he sees it. This is of very great importance when his machinery becomes more complex and speeded up, as it is in the war plants in our country today. When time is of the essence, the use of high-speed punch presses, drill presses, lathes, and rapidly moving assembly lines only emphasizes the importance of this factor. There is not available at present, however, a simple method of determining the speed of vision.

The so-called tachystoscope has been used in certain instances to measure the speed of vision; but it is not yet widely enough available, nor has its use been standardized to a point to justify using it in industry on a large scale.

Conclusion

In conclusion, then, it may be stated that those of us in industrial eye hygiene are not in a position as yet to state authoritatively just what percentage of this or that type of accident is due to any one or any combination of the various component visual skills, irrespective of other factors such as proper light, etc. There is good reason to assume, however, that this percentage may be high enough to justify carrying out projects in industry, in which these various skills will be carefully and accurately measured against accident type and frequency. We hope that we will then be able to learn the facts, and disseminate sufficient information so that the terrible toll of industrial catastrophies may be measurably cut down.

The Forum

THIS section is reserved for brief or informal papers, discussions, questions and answers, and occasional pertinent quotations from other publications. We offer to publish letters or excerpts of general interest, assuming no responsibility for the opinions expressed therein. Individual questions are turned over to consultants in the particular field. Every communication must contain the writer's name and address, but these are omitted on request.

Rehabilitation of the Uni-Ocular Patient *

Most patients, during their stay in Hospital after sustaining the loss of one eye, seem to be very little conscious of disability. But as soon as they begin to mix with their relatives and friends, they become accident-conscious and inclined to exaggerate their difficulties, the more so if there is delay in payment of what they consider adequate compensation.

It seems very desirable, therefore, that active steps should be taken as soon as possible to re-educate the disabled; and such re-education can commence within a day or two of the removal of the eye.

The following account of the arrangements made in this district is put forward to promote interest in this part of the problem of rehabilitation after injury, and may stimulate further experiment.

Other areas almost certainly have more cases with which to deal. So the general outline of treatment only is given, and this in very simple language.

By the co-operation of the Rehabilitation Department of the Royal Sussex County Hospital, patients who have had an eye removed at the Sussex Eye Hospital are sent over to the Department as soon as they are allowed up. But, the rehabilitation starts while the patient is still in bed, on the second or third day after operation. The patient is given knitting with a cotton reel and crochet hook. He usually finds it good fun, and soon becomes efficient.

On the fourth or fifth day, the training proper begins at the Rehabilitation Department. This Department is in the hands of a

* Reprinted with permission from *The British Journal of Ophthalmology*, October, 1943.

Specialist, with specially trained Sister and Nurses. Patients with all kinds of disability are treated in the Department.

The Sister and Nurses responsible for the training of the uni-ocular patients have been taught the physiology of uni-ocular perception of depth, as follows:

A. Extrinsic Factors* (1) Psychological (*a*) Aerial perspective. (*b*) Distribution of light and shade. (*c*) Overlapping of contours. (*d*) Geometric perspective. (*e*) Interpretation of size. (These can all be demonstrated by the choice of a good colored landscape painting). (2) Parallactic Displacement.

B. Adjustment Factors. (1) Effort of accommodation. (2) Measurement by "estimation."

They also know the patients' difficulties. (1) Psychological. (*a*) "Loss of sight in one eye means loss of half his vision." (*b*) "Strain on the remaining eye." (2) Physiological. (*a*) Loss of a small amount of field. (*b*) Loss of stereoscopic vision.

The notes for the guidance of the trainers are as follows. Some people have a "master eye," *i.e.*, one which they use more than the other, although both may have good vision. Such patients will have greater difficulty in adjusting to the uni-ocular state, if the master eye is put out of action.

Treatment. (1) Psychological. (*a*) Encouragement, because the loss of sight is not really great. He must not be allowed to think that he is blind. Therefore, mixing with patients with other disabilities is good for him. (*b*) Either one of paired organs is quite capable of taking on the functions of both without injury to itself, *e.g.*, right-handedness, or one kidney.

(2) Physiological (*a*) The loss of field is relatively small, and this difficulty can be overcome by a slight false torticollis, and by keeping known objects on the blind side, such as by walking next to the railings in the street. The patient can take exercise in walking to avoid objects and touch others *en route*. (*b*) The loss of perception of depth is very real, and constitutes the main difficulty to overcome. Explanation of the extrinsic factors which make for conception of depth should help the patient, especially for estimating distant objects. But for nearer things, for instance, the depth of a step up or down, "practice makes perfect."

The patient can do gymnastics, climbing up and down wall ladders, and stepping over objects on the floor. This helps to keep him fit in body, and, in company with other disabled persons, to take him out of himself.

To hasten the time when the patient can resume a remunerative occupation, hand-and-eye training is essential. The following exercises become progressively more difficult.

* *Duke-Elder.*—Text-Book of Ophthalmology, Vol. I.

"Knitting Nancy" (cotton reel knitting).
Peggity, or a similar game.
Sewing canvas.
Rawlplugs and screws.
Hammering nails.
Carpentry or other hand work.
Ping-pong.

Treatment is given daily, and the patients are purposely not taught things ordinarily done by the blind.

It has been found that the above treatment provides a stimulating and interesting mixture of work and play. It necessitates a slightly longer stay in Hospital, say ten days to a fortnight in all. But the patients go out in a much better frame of mind.

—C. G. SCHURR
Hove, England

Report of Discussion on Vision Testing Procedures

Screening programs for the discovery and follow-up of visual difficulties in preschool and school children were discussed at a meeting called by the National Society for the Prevention of Blindness in New York City on November 9, 1943. With Thomas H. Johnson, M.D., Chairman of the Society's Committee on Vision Testing Procedure, presiding, the group included ophthalmologists associated with school systems; administrators of school and public health and welfare services and of prevention of blindness agencies from four neighboring states; and several members of the staff of the U. S. Children's Bureau. Present development of screening programs and the principles and policies which should guide such programs were the topics considered.

Extent of Development of Screening Programs

Screening tests are far less commonly available to preschool children than to school children. Although frequently included in "school readiness" conferences, routine tests are rare in well-child conferences and nursery schools. Thus the number of preschool children whose vision is tested is quite limited, and the tests are usually delayed until children are four to six years of age. Most of the testing for this group is done by nurses, although in a few places volunteers are trained to render this service under the supervision of nurses.

Most elementary schools having a school health service test the children's vision annually. However, some give no tests to children below the third grade. In schools with no organized health service, routine testing is dependent upon the initiative of individual teachers or of local school administrators. While annual vision tests are continued through high school years in some systems, in others they are not given in grades beyond the elementary or junior high school. In the past most of the visual screening in schools has been done by nurses, but educators are coming increasingly to rec-

ognize the value of transferring this responsibility to the classroom teachers, the nurses serving as consultants and, if necessary, rechecking those whose vision is believed defective.

Methods of Testing

The test most used in screening is the Snellen, with consideration given also to observed signs of eye difficulties. In some places muscle balance and color vision are also tested, and in a few the Snellen test is supplemented by tests for hypermetropia (farsightedness).

Other tests discussed at the meeting were the Massachusetts Vision Test, the Rapid Visual Screening Test and the Telebinocular.

The Massachusetts Vision Test—The equipment for this test was exhibited and the tests discussed by Albert E. Sloane, M.D., who served as consultant ophthalmologist in its development, and Lura Oak, Ph.D., Director of Field Service in Child Growth and Development of the Division of Child Hygiene of the Massachusetts Department of Public Health, who has charge of the project. This battery of tests utilizes the Snellen test, (with controlled lighting) plus spheres for detecting hypermetropia, and Maddox rods for discovering latent muscle imbalance. Special equipment and a standardized procedure have been developed to require a minimum of training for those who give the tests.[1] Teachers, nurses, and technicians have used the tests satisfactorily after being trained by the technical staff of the Massachusetts Health Department.

The reliability of this battery has been measured by comparison with an ophthalmological examination of 248 children. From this it was found that the battery missed 2 per cent of the children whom the ophthalmologist considered to need care, and screened out 9 per cent whom the ophthalmologist found to need no treatment.[2] Considering the latter a desirable margin of overselectivity, Dr. Sloane stated that many of these were children with some slight visual difficulty for which the need of eye care could be determined only by a thorough examination and an appraisal of the needs of the individual child. Dr. Sloane further reported that 86 per cent of those failing the battery of tests were screened out on the basis of the Snellen test alone—the other 14 per cent passed the Snellen but failed either on the plus sphere or the Maddox rod tests.

The equipment and battery of tests have been approved by the Council on Physical Therapy of the American Medical Association as a suitable method of screening in schools.[3] Dr. Oak reported that it was proving equally valuable for screening preschool children as young as three years of age, and is being increasingly used in child health services as well as in both ele-

mentary and high schools throughout Massachusetts and elsewhere. The tests are given in a routine order and, to conserve time, are stopped at the first point of failure. Thus it takes about 5 minutes per child in the preschool group, and ranges down to 1 minute per child for those above the third grade.

Through the Field Service in Growth and Development, the State Health Department carries on a program for promoting the use of the battery and training testers. This, however, is in co-operation with local ophthalmologists, school and health authorities. They report that while the tests have been widely accepted, a few ophthalmologists do not approve the use of the plus spheres and Maddox rods in screening.

The Rapid Visual Screening Test—The equipment, reports and photographs of the procedure were displayed and discussed by James G. Morrissey, M.D., consultant ophthalmologist for schools of Yonkers, New York, who has developed this test. Emily A. Pratt, M.D., Supervisor for Eyes and Ears of the New York State Department of Education, supplemented this discussion.

This is a group test used for simultaneous testing of all the children in a classroom while they sit at their desks. As the tests are made at distances ranging from 12½ to 32½ feet from the charts, specially designed symbol E charts are used, drawn to a scale which approximates the Snellen sizes for comparable distances. If the last line read correctly at any particular distance is the one which at that distance approximates 20/20 or better of the standard Snellen chart the visual acuity is classed as "normal," while if this line cannot be read at this distance the visual acuity is considered "defective." All children whose vision is recorded as defective, on the basis of this test, receive an ophthalmological examination by Dr. Morrissey.

No controlled lighting is used. Charts are placed on the blackboard at about eye level of an adult when standing, one chart being used for each two rows of desks.

The children copy the symbols they can see, with each eye separately, then with both together. The unused eye is covered with a small card held by the child in the hand not used for writing. In photographs of this procedure some of the children did not seem to have the eye fully covered and there was some discussion as to whether one teacher could adequately supervise a classroom full of children taking this test. Dr. Morrissey and Dr. Pratt felt that the teacher would know which ones need watching.

All kindergarten children receive an ophthalmological examination by Dr. Morrissey, supplemented later by a modification of the group test described above. Treatment or glasses are recommended for 25 per

cent of all of the kindergarten children, and careful follow-up has reduced the number of defects found subsequently in the grades.

Emphasis was placed on the educational aspects of the program. The entire school participates and welfare agencies aid in the follow-up. Dr. Pratt reported the program is popular with school administrators and is being adopted in other communities in New York State where, however, the recheck is given by a teacher-nurse instead of the ophthalmological examination.

There were a number of questions about the reliability of the findings but figures did not seem to be available as to the number of missed cases because (except in the kindergarten group) only those whose vision is classed as defective receive an ophthalmological examination.

Telebinocular—This stereoscopic testing instrument was exhibited with the charts and record forms. Discussion brought out that it is popular with guidance and remedial reading departments, but that many schools discontinue its use after a brief trial. In 1938 the Council on Physical Therapy of the American Medical Association declared the charts unsuitable for school use[4] and at about the same time several studies appeared in ophthalmological literature indicating apparent inaccuracies in the findings as compared with ophthalmological examinations. The manufacturer reports that the charts and records have since been revised, but as far as known the revised material has not been evaluated by the American Medical Association. Nor have any more recent studies appeared in the ophthalmological literature. However, in 1943 the Joint Committee on Industrial Ophthalmology published a report on the instrument, charts, and records provided for industry by the same manufacturer. These are very similar to those used in schools. This report indicates difficulties similar to those found in the school tests and recommends that the industrial tests should be used only under the supervision of ophthalmologic or medical departments.[5]

Methods and Problems of Follow-Up

In well-child and "school readiness" conferences the parent is usually present at the time of the vision test and physical examination, and visual findings are discussed by the physician and nurse with the parent at this time. In subsequent conferences the nurse assists the family in planning necessary examinations and treatment.

In schools if an annual physical examination is given, the vision test usually precedes the examination and the findings are taken into consideration in the physician's appraisal of the child's health. Where parents attend the examination or subsequently come to the school for a conference, visual find-

ings are discussed with them by the physician, nurse, or both. In some schools the teacher is also present. However, more frequently a printed form is used to report suspected defects to the parents, and is usually given to the child to take home. This states that inspections or tests made at school indicate the need of an eye examination and recommend that the family physician be consulted. Although space is usually provided for a return report from the specialist, it is seldom used, and the school receives information on the findings of the specialist only in exceptional cases where a personal contact is made by the school physician or nurse.

When a child returns with glasses the nurse commonly rechecks and, if vision is still not normal, often contacts the specialist, but if other types of treatment are being used, the school personnel may be unaware of it.

The classification of visual defects varies from one school system to another and in many places evaluation of the seriousness of the suspected defect in each individual case is largely left to the judgment of the tester. Snellen findings and observed signs of eye difficulties are usually the chief basis for advising an eye examination and for determining the urgency. In some places parents are notified if a child has a visual acuity of less than 20/20; in others, only if lower than 20/30; in still others, only those having less than 20/40 are reported. Some schools use a "X, XX, XXX" classification. Under this system X denotes either minor signs of eye difficulty and a normal visual acuity, or a first finding of 20/30 with no observed evidence of difficulty. If the latter is true, teachers and, in some places, parents are asked to watch the children closely. Rechecks are sometimes made a few months later and if the visual acuity has not improved, the defect is then classed as XX. A visual acuity of 20/40 or 20/50 is also classified XX. Notices are sent to parents of all children thus classified. The XXX classification is reserved for those who have a visual acuity of 20/70 or less or have marked evidence of being in urgent need of care, and usually personal contact is sought with the parents.

A Screening Program Under Ophthalmological Guidance

Upon request, Inez Wilber, M.D., school ophthalmologist of Washington, D.C., outlined the program for preschool and school children under the Municipal Department of Health which conducts well-child conferences and provides the medical and nursing service for the schools. Two years ago Dr. Wilber was appointed full-time school ophthalmologist, a staff nurse was assigned to assist her, and she was given charge of an eye clinic to serve preschool and school children. Re-

cently a second nurse and a clerk have been added to the staff and a co-ordinating committee on school health has been appointed, with representatives from the departments of health and education. The entire eye program in schools and in preschool health department services is under the guidance of Dr. Wilber and her staff. Direct responsibility for carrying it through is, however, delegated to the nurse assigned to the particular school or preschool service, in co-operation with principals and teachers or with volunteers in preschool services.

Screening of preschool children was initiated several years ago in the well-child conferences through a co-operative program in which the District of Columbia Society for the Prevention of Blindness trained and supervised volunteers who gave the tests in the conferences, follow-up being done by physicians and nurses of the health department staff. The entire program has now been taken over by the health department which is also initiating screening tests in nursery schools.

Until this year vision testing in schools was limited to the first four grades, but it is now being extended to include the entire school population. Methods have been standardized, illuminated chart-units provided, and an educational program developed for nurses and teachers with demonstrations and mimeographed instructions on vision testing procedures. Special record forms used were displayed. Teachers are now making most of the tests with nurses as consultants, and organizing the work in each school with the aid of the principals. The tests are to be completed by December 1, 1943, and reports of the teachers' tests to be routed to the nurse through the office of the principal. The nurse will then recheck the children whose visual acuity is below a specified standard (20/40 up to third grade and 20/30 for all others). The information will be transferred to follow-up records and the original reports forwarded to Dr. Wilber.

Parents notified of suspected visual defects are asked to fill out a form indicating what they plan to do about it and the name of the specialist to whom they expect to take the child, or to indicate whether they need assistance in arranging for an eye examination. The nurse then gives the child a report for the specialist to fill out, or, if assistance is requested, arranges a conference with the family. Those unable to pay for private care are referred to the school eye clinic. When specialists' reports are returned the information is transferred to the child's health record and the reports are forwarded to Dr. Wilber. Nurses also receive reports from the school eye clinic for children referred there.

Discussion brought out that while ophthalmological guidance is available in the school systems of many large cities, it is seldom as compre-

hensive as that described here, and is totally lacking in smaller cities and in most rural areas. New York is the only state which has an ophthalmologist on the staff of the department of education. Twenty states have sight conservation committees of ophthalmologists who might assist in the development of policies and programs for vision testing.

Principles and Policies

Several of the ophthalmologists present stated, and all seemed to concur, that the goal for all eye health programs for children should be an ophthalmological examination for every child before school entrance, with such re-examinations as are needed. Screening tests should be viewed as a necessary adjunct to, but not a substitute for, such examinations. Early discovery of visual difficulties is an important factor in securing best results. Latent muscle imbalance and conditions likely to contribute to muscle imbalance or strabismus are often not discovered without an examination or screening tests. Since early treatment of these conditions offers the best hopes of bringing the whole integrated act of seeing to normal, routine screening should start as early in the preschool years as possible. This also permits the child to become oriented to glasses before school entrance if these are needed. Routine screening in school should start as soon as the child enters school and should continue annually throughout his school life. In the upper grades and in high school the findings should be taken into consideration in guidance programs.

Evaluation of screening tests should be based on a comparison of the findings for each person tested with those of an ophthalmological examination. While there should be a high degree of correlation between test findings and the ophthalmological examination, the screening tests should select some with borderline conditions whose need of treatment can only be determined by a thorough eye examination. Thus screening tests should give a margin of "over-referral." For best results screening tests should be adaptations of those commonly employed by eye specialists, suitable for use by testers who have a minimum of training, hold the interest and be within the capacity of the individuals to be tested.

It was agreed that in determining the need of an eye examination, tests should be supplemented by observation of signs and symptoms of eye difficulty, the continued presence of which should take precedence over test-findings in deciding both the need of such an examination and its urgency. There was considerable stress on the importance of such observations by teachers who are in daily contact with the children. However, as the value of observations is in direct proportion to the capacity of individual

observers, all who are responsible for the care of children need training in recognizing and reporting the signs of eye difficulties.

Although the Snellen test, when properly made, was considered the most important single test in screening out those who have visual defects, it measures only the visual acuity. It should therefore be supplemented by observations and by tests designed to detect other significant conditions.

Vision tests of small children are often less accurate than those for older children. This should be taken into consideration in recommending an eye examination on the basis of the Snellen test findings. Hence it was recommended that, unless other signs of eye difficulty are noted, examination need not be advised for children under the third grade who have a visual acuity of 20/30 especially on the first test, but should be for all who have 20/40 or less. However, an eye examination should be planned for all children in the third grade or above who have a visual acuity of 20/30 or less, even if there are no observable signs of difficulty. Prompt and careful attention should be given to those with a markedly reduced visual acuity and to those whose visual acuity shows a change, especially a decrease, however slight.

Closer co-operation between eye specialists and preschool and school health services was considered to be urgently needed. This should include the development of satisfactory routine methods of exchanging information concerning the problems of individual children and increased responsibility on the part of the specialists for interpreting eye problems and policies of the referring agency in recommending examination. Ophthalmologists should guide the programs, helping agencies to standardize procedures and policies and to develop adequate educational programs.

More careful consideration was recommended in the selection and preparation of testers. Delegation of this responsibility to the classroom teacher assures the test being given by a person familiar with the child, and offers the best possibility for correlating the test-findings with daily observations and for utilizing the test as an integral part of the child's health education. Nurses, however, should give consultant services to the teachers, explain to parents the need of examination and inform them of resources and interpret the doctor's findings and recommendations to both parents and teachers. Preparation for these duties should be a fundamental part of the education of both groups and should be followed by an in-service educational program under ophthalmological guidance.

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ELEANOR W. MUMFORD, R.N.

Sore Eyes May Mean Trachoma*

Trachoma is one of the diseases sometimes called "granulated eyelids" or "red sore eyes." It is an inflammation of the lining of the eyelids and the eyeball. The disease is infectious or "catching."

The early signs are watering, itching and burning, or a feeling as if there were something in the eye. Light causes pain in the eyes and the tears flow excessively. The feeling of something in the eye is so marked that many trachoma patients tell the doctor that the trouble was caused by getting dust or sand in the eyes.

Trachoma Is Widespread

Historic records indicate that trachoma was known in ancient times. It has spread from Egypt to all parts of the world. In the United States it is seen occasionally in all sections. It is very prevalent in an area west from West Virginia, through Kentucky, Tennessee, Missouri, Arkansas, Oklahoma and Kansas, and among the American Indians.

Blindness Can Be Prevented

Nobody dies from trachoma, and for that reason not many people become alarmed about it, but it is deserving of serious consideration because the damage to vision causes a great amount of suffering and loss of earning power. If not treated, the eye becomes more and more inflamed, until the cornea, or clear front of the eyeball, becomes clouded by blood vessels growing into it. In time, scars form on the inside of the lid, and when these scars con-

* Reprinted with permission of the Trachoma Control Service, Arkansas State Board of Health (Tr. Folder No. 1—1944). Suggestions from U. S. Public Health Service, National Society for the Prevention of Blindness, and the Metropolitan Life Insurance Company.

tract, or "draw," as all scars do, the edge of the lid is pulled inward, causing the lashes to scratch the eyeball. This is very painful and adds to the cloudiness of the eye. Partial or complete blindness may result, but fortunately this need not and will not happen if the person showing signs of the disease will put himself under the care of a doctor.

Treatment Is Not Painful

The present treatment is not painful as in the olden days. It consists of sulfanilamide given in tablet form, by mouth, in small doses. This treatment should be taken under supervision of a physician who can determine the proper dosage. The local treatment consists of drops of sulfanilamide solution and cleanliness. When the doctor's directions are followed carefully there are no serious reactions to this treatment. Some nausea and dizziness may be noticed, but if treatment is continued the results are worth this slight discomfort. Treatment should be started as early as possible. It seldom becomes necessary to operate on the eyelids unless the disease is so far advanced before treatment that lashes have turned inward.

Trachoma Is "Catching"

Trachoma is spread from one person to another by getting the infective material from the eye of a person having trachoma into the eye of another person. This may happen by using the same towel, wash basin, handkerchief, and other articles. It is not safe to sleep in the bed with a person who has trachoma. Trachoma does not produce immunity, like chicken pox and some other diseases. For this reason a person may be cured and then "catch" trachoma again. It is important that all cases in a family be treated.

It is of the greatest importance to prevent the spread of the disease. The following suggestions to trachoma victims will help someone else from becoming blind:

1. Place yourself under treatment by a reputable physician without delay, an eye physician, if possible. Continue treatment until the physician dismisses you.

2. If the doctor says you have trachoma, *have all members of your family examined. You would not want them to blame you if they became blind from trachoma.* Never let anyone use medicine or drops given to someone else.

3. Keep your face clean, especially about the eyes. Wash your hands before and after touching your eyes.

4. Have clean handkerchiefs or clean cloths to wipe your eyes. See that they are boiled or burned after use.

5. Do not leave your towel, soap, or wash basin where other persons can use them, for they may also get trachoma.

6. Babies may catch trachoma, so be careful in cleaning the baby's face. Use wash cloths that have been boiled, and wash your hands before bathing the baby or touching his eyelids.

7. *Glasses Will Not Cure Trachoma.* Do not let anyone sell you glasses in the hope that they will cure you.

—K. W. COSGROVE, M.D.
Little Rock, Ark.

Editorial

Dear Subscribers and Friends!

WE have a lot of explaining to do. Readers must be asking all sorts of questions. First of all: "Where are our SIGHT-SAVING REVIEWS?" Second, "What are you going to do about it?" and third, "What is the idea of sending us an issue bound in blue?"

We shall begin by answering the last question first. The War has deprived us of the possibility of obtaining more paper of the usual color, and we have been offered instead a variety of less interesting colors from which to choose; we thought the blue might be a welcome change, and an advance color proof seemed promising to us. We hope you like it.

Now, about the past issues of the REVIEW—Volume XIII lacks the last issue. This will be sent you, in its old jacket, as a Supplement devoted to the subject of Industrial Ophthalmology, based on talks given by specialists at a Seminar conducted under the auspices of the National Society for the Prevention of Blindness. The Index for Volume XIII will not be bound in the Supplement but will be sent separately. There will be no Spring, 1944 issue of Volume XIV the REVIEW, but you may be sure there will be four issues for the volume, even though we are starting with this, the Summer number. These delays, as we have told you in the past, are due to added pressure of work directly related to the war effort, coupled with personnel shortages. These hardships have been felt keenly too by many of our loyal friends and co-workers upon whom we used to count for articles and book reviews, and we have found it difficult to get the kind of material we feel would be most useful to our readers.

May we therefore call upon you and beg your indulgence with us during these difficult times? We shall be glad to receive suggestions, manuscripts, book reviews, and notes that any of you may care to submit. Let us know what types of articles you would like to read. Help us make the REVIEW the kind of magazine that will be of the greatest service to you.

Note and Comment

Linda Neville to get Leslie Dana Medal.—The Leslie Dana Gold Medal, awarded annually for outstanding achievements in the prevention of blindness and the conservation of vision, will be presented this year to Miss Linda Neville of Lexington, Ky.

Miss Neville who needs no introduction to workers in sight conservation is the founder of the Kentucky Society for the Prevention of Blindness which is virtually a one-woman organization, and she is known in her home state as "the angel of Kentucky." During the past 40 years, she has utilized her Bryn Mawr education, taken advantage of her social connections and spent practically her entire inheritance in order to bring sight to hundreds of babies, young children, and adults, from the poverty-stricken mountain districts of Kentucky, who needed medical care or eye surgery.

Miss Neville, who is now 70 years old, was born in the same house which has served as the headquarters for her prevention of blindness activities. At least 1,000 persons have received skilled medical care and have been saved from the doom of darkness through her intercession.

Selection of the recipient of the Leslie Dana Gold Medal is made by the St. Louis Society for the Blind, through which the medal is offered by Mr. Leslie Dana of St. Louis. This highly prized token of recognition in the field of public health is given upon the recommendation of the Association for Research in Ophthalmology.

The conditions of the Leslie Dana Medal award set forth that it is to be made for "long meritorious service in the conservation of vision; in the prevention and cure of diseases dangerous to eyesight; research and instruction in ophthalmology and allied subjects; social service for the control of eye diseases; and special discoveries in the domain of general science or medicine of exceptional importance in conservation of vision."

National Health Council Election.—Readers of the REVIEW will be pleased to hear of the election of Mrs. Eleanor Brown Merrill,

Executive Director of the National Society for the Prevention of Blindness, as President of the National Health Council, for 1944. She is the first woman to be elected president since the founding of the Council in 1921. Mrs. Merrill succeeds Dr. George S. Stevenson, Medical Director of the National Committee for Mental Hygiene.

Other officers are: Vice-President, Dr. Walter Clarke, Executive Director of the American Social Hygiene Association, who succeeds Dr. Kendall Emerson, Managing Director of the National Tuberculosis Association; Secretary, Professor Maurice A. Bigelow, President of the American Eugenics Society; Treasurer, Dr. William F. Snow, General Director of the American Social Hygiene Association. Dr. G. Foard McGinnis, Director of Medical and Health Services, American Red Cross, was elected to the Board of Directors.

The National Health Council, with headquarters at 1790 Broadway, New York City, is a clearing house of 20 voluntary health organizations. As one of its activities, the Council maintains a library whose facilities are used by research workers from all parts of the United States and, particularly, by students of medicine, nursing and public health from local and nearby colleges and universities.

The National Health Library contains more than 6,000 volumes and 30,000 pamphlets dealing with public health, sanitation, and related subjects; more than 500 professional journals and technical periodicals are received regularly from all parts of the world. As an aid to public libraries in the selection of books on health subjects, an annual guide is prepared for publication in the Book List of the American Library Association; in addition, the library issues its own weekly bulletin, giving brief digests of current magazine articles pertaining to health matters.

Active member agencies in the National Health Council include the following: American Eugenics Society, American Heart Association, American Public Health Association, American Red Cross, American Social Hygiene Association, American Society for the Control of Cancer, American Society for the Hard of Hearing, Conference of State and Provincial Health Authorities of North America, Maternity Center Association, National Committee of Health Council Executives, National Committee for Mental Hy-

giene, National Organization for Public Health Nursing, National Society for the Prevention of Blindness and the National Tuberculosis Association.

Associate member agencies are: American Association of Medical Social Workers, American Diabetes Association, American Nurses' Association, Foundation for Positive Health, Laymen's League Against Epilepsy and the Planned Parenthood Federation of America.

The U. S. Public Health Service and the U. S. Children's Bureau are advisory members.

Seminar in Industrial Ophthalmology.—The Society's staff, in co-operation with leading opthalmologists, this Spring held a very successful Seminar in Industrial Ophthalmology, consisting of five weekly sessions. It is hoped that through the co-operation of a number of Federal agencies, the need for an adequate eye conservation program will be brought to the attention of the management of some 30,000 industrial plants. The Seminar was designed to help meet the need for additional industrial ophthalmologists, which is expected to result from this project.

The joint Committee on Industrial Ophthalmology of the American Medical Association and the American Academy of Ophthalmology and Otolaryngology co-operated in preparing the Seminar. Lecturers for the meetings included leading ophthalmologists as well as industrial and illuminating engineers of outstanding repute, and approximately 60 ophthalmologists registered. The five subjects covered were: (1) Survey of Eye Conditions in Industry and of Industrial Eye Hazards; (2) Visual Examination, Refraction and Prescription for Industrial Working Conditions; (3) Illumination for Industry; (4) First Aid and Industrial Nursing; (5)*a*. Establishing an Industrial Eye Conservation Program; *b*. Governmental and Voluntary Health Agencies in the Industrial Eye Field; *c*. Compensation Laws as They Affect Ophthalmologists.

An Eye Bank.—Prevention of blindness has taken another step in its advancement in the establishment of an "eye bank" for the storage of human corneas, at New York Hospital under the joint auspices of that institution and Manhattan Eye, Ear and Throat

Hospital. Heretofore a dearth of eye tissue for transplantation has denied the benefit of this procedure to some whose vision could have been restored thereby. With the development of methods for preserving such tissue, a "bank" to make corneas available on need became a logical undertaking.

Nineteen hospitals in the Metropolitan Area are co-operating with the two above-named hospitals in this project. For the present, eyes can be accepted only from patients in these participating institutions. The eyes can be obtained either from living persons who have lost the sight of one or both eyes, provided the corneas are healthy; or from individuals who arrange to have their eyes removed immediately after death.

We think it is important to call attention to the fact that this wonderful operation—corneal transplantation—can restore the sight of only a small proportion of the 200,000 blind in the United States. Unfortunately, much disappointment and heartache have resulted, in the past, from publicity regarding such operations; the families of many blind persons do not understand that this operation is only for those blind from corneal opacities.

Summer Courses for the Preparation of Teachers and Supervisors of Sight-Saving Classes.—Three courses for the preparation of teachers and supervisors of sight-saving classes were offered during the summer session of 1944. Because of the difficulties of transportation, these were arranged to meet the needs of supervisors, teachers, nurses, welfare workers and others in the far west, the middle west, and the east. All three courses met standard requirements and offered graduate and undergraduate credits. They were held at the University of California, Los Angeles, Calif.; Michigan State Normal College, Ypsilanti, Michigan; and Teachers College, Columbia University, New York, N. Y.

American Board of Ophthalmology Moves its Office.—The Executive Office of the Board has moved to the American Board of Ophthalmology, Cape Cottage, Maine. The third edition of the *Directory of Medical Specialists* listing names and biographic data of all persons certified by the fifteen American Boards is to be

published early in 1945. Collection of biographic data of the diplomates certified since the 1942 edition, and revision of the older listings in that volume are now going forward rapidly. Diplomates are requested to make prompt return of their notices regarding their biographies as soon as possible after receiving the proper forms from the publication office to be mailed to them.

Prevention of Blindness in Bengal.—We have received the 13th Annual Report of the Association for the Prevention of Blindness, Bengal, which was founded in 1930 through the stimulation of Mr. and Mrs. Rufus Graves Mather, the latter being the founder secretary of the New York Association for the Blind. The four purposes of the Association outlined in December of that year at a convention of ophthalmic surgeons, were education, establishment of travelling eye dispensaries, legislation, and training in ophthalmology. Public education for the Association is handled in all ways —lectures, films, publications, posters.

It is estimated that there are a million and a half blind persons in India, and three times that number partially so. Trachoma is listed as one of the chief causes, and a proposal is before the Indian Research Fund Association for a grant to implement research in this disease.

The Report contains several appendices including financial statements and minutes of the Association and its adjuncts, lists of schools where lectures and demonstrations have been given, and reports on the five travelling eye dispensaries and on the eye examination and lecture unit.

New Sight Conservation Motion Picture Makes an Impression.—Eleven state departments of health and of public welfare and 17 state colleges and universities have requested preview of the Society's new sound film, Eyes For Tomorrow, and 23 prints of the film have already been sold, since its release March 1.

Just a reminder: the price of the film is $50.00, complete with reel, metal can, and shipping case. It may be rented for $5.00 per showing day or $25.00 a week, exclusive of time in transit.

Spanish and Portuguese versions of the film are also being released at an early date by the Office of the Coordinator of Inter-

American Affairs; and it is of interest to report that inquiry has been received regarding the possibility of obtaining a Chinese version, for use in China.

British "Back to Work" Exhibition.—Last February saw the formal opening of an exhibition dealing with employment of the handicapped, organized by the Ministries of Labour and National Service, and of Information; St. Dunstan's and the National Institute for the Blind.

The Rt. Hon. Ernest Bevin, Minister of Labour and National Service, in his opening speech, gave voice to the organizers' desire that the Exhibition be looked at objectively: that disabilities, more frequent during war than otherwise, be dealt with on a basis as nearly equal to the normal as possible; and that it be remembered that the disabled can form productive atoms of the national economy if intelligently utilized.

The three main causes of disability—industry, war, and congenital handicaps—and two aspects of after treatment—vocational training and co-operation with voluntary agencies—are presented at the Exhibition.

New Edition of Sight Conservation Catalogue.—The Society has just published a new edition of its Publication 32, "Catalogue of Publications." This brings up to date the list of materials published and distributed by the Society, and includes also a listing of Vision Testing Charts, Posters, and Films. Single copies will be sent upon request to readers of the REVIEW.

Knudsen Award Goes to Dr. Vonachen.—On May 11 the Knudsen Award of the American Association of Industrial Physicians and Surgeons was presented to Dr. Harold A. Vonachen, medical director of the Caterpillar Tractor Company, Peoria, Illinois, for initiating and developing a plan to fit disabled workers to jobs and jobs to disabled workers, started in his own plant two years ago and developed through close co-operation with the medical personnel, safety division, and training and manufacturing department. When the success of the plan at the Caterpillar plant was assured, it was carried to the community, where 17 community organiza-

tions are represented on the executive committee of what has become the Peoria Plan for human rehabilitation.

Encouraging the Use of Protective Goggles.—The National Society for the Prevention of Blindness is anxious to advance its industrial eye safety and utilization program. With this in mind, it is asking readers of the REVIEW to give it the benefit of their experiences in regard to the use of protective goggles. A brief note or description of any methods or devices which have been found helpful in promoting the wearing of protective goggles will be greatly appreciated. This first-hand information will be summarized and passed on to those wishing the benefit of accumulated experiences.

Postwar Jobs in Vocational Rehabilitation.—Returning soldiers, ex-war workers, students, teachers, parents, counselors, and others who want to know about professional opportunities in helping injured persons to reestablish themselves economically, will want to read the composite summary of available literature on "Vocational Rehabilitation as a Career" just completed by Sarah Allen Beard and published by Occupational Index, Inc., New York University, New York 3, N. Y.

Sight Conservation Broadcasts.—Public health education concerning the danger of eye accidents in industry and the possibility of preventing blindness from glaucoma through early diagnosis and treatment is being brought to the American public through two 15-minute radio programs, produced for the Society by the Radio-Recording Division of the National Broadcasting Company. Electrical transcriptions of these dramatizations, entitled, "The Ultimate Victory is in Sight" and "A Stitch in Time," have been broadcast, to date, by 80 local stations in 37 states and the District of Columbia. Many additional stations are expected to schedule these programs within the next few months.

National Conference of Social Work.—The Society was represented at this year's National Social Work Conference in Cleveland, by Mrs. Merrill; C. Edith Kerby, associate in program

planning and research; and Virginia Smith, staff associate. At the Society's special meeting, presided over by Miss Ruth B. McCoy, Assistant Director, Bureau of Services for the Blind, New York State Department of Social Welfare, Mrs. Merrill gave a paper on the subject, "Prevention of Blindness on the Home Front"—a progress report on prevention of blindness activities in the United States during the past ten years. This paper appears as the first article in this issue of the REVIEW.

Prevention of Blindness Institute Founded in Uruguay.—Through Dr. A. Vasquez-Barriere of Uruguay has come word that the National Institute for the Prevention of Blindness has been founded, with headquarters in Montevideo. The Society has furnished the Institute with material, and is being consulted regarding training of personnel for the new organization.

British Medical Industrial Service.—Great Britain has organized an industrial medical service to cover all plants. Under the auspices of the United States Government, Dr. W. E. Chiesman, representing the Industrial Medical Officers Association of London, is travelling extensively over this country to study industrial medical practices and methods. Since eyesight conservation is one of England's serious industrial problems, it is one of Dr. Chiesman's chief concerns, and the Society has facilitated his study by conferences and by giving him letters of introduction to safety and medical directors of divers industrial plants, to government and state medical officials, and to practicing ophthalmologists who are leaders in the field of industrial ophthalmology.

Glaucoma Exhibit.—The Society's Committee on Glaucoma (Chairman, Mark J. Schoenberg, M.D.) was fortunate in obtaining the valuable co-operation of other ophthalmologists in presenting an extensive exhibit covering the various aspects of the glaucoma problem, for the annual meeting of the New York State Medical Society, in May. Material was organized under the following headings: pathology, gonioscopy, scotometry, perimetry, pupillography, geographic distribution of glaucoma, special glaucoma clinics and services, the general practitioner's part, tonometer checking charts,

and the industrial aspects of glaucoma. It is expected that this same exhibit, with some supplementary material will be displayed at the forthcoming meeting of the American Academy of Ophthalmology and Otolaryngology, in Chicago, early in October.

Newsletter on Ophthalmology for Overseas.—International exchange of scientific advances has of course been interrupted by the war. To keep fellow-Americans and scientists of other nations informed as to progress in this country, the Division of Ophthalmology, University of California Medical School, has inaugurated a newsletter, which it expects to issue monthly. Contents of the first issue are abstracts of five papers from American ophthalmological publications, and future issues will follow the same pattern.

"Metal Locator" for Eye Saving.—The first operation on a human eye with the aid of the "metal locator," which helped save many lives at Pearl Harbor, has been reported at the Mt. Sinai Hospital in New York City. The device, invented by Samuel Berman, New York subway engineer, was used after Pearl Harbor for finding bullets and shrapnel in the bodies of the wounded, but Mt. Sinai is the first to use it for so delicate a task as finding a steel splinter about one-eighth of an inch long within the eyeball, near the retina.

The particle had been localized by x-ray. After a surgeon had exposed the back of the eyeball, the tip of the locator probe was run over it. As the metal point was moved close to the location of the steel splinter, the hand of a sensitive ammeter on the apparatus was deflected. The point at which the maximum deflection occurred was the spot directly over the splinter. Incision was then made and the splinter extracted with an electromagnet.

Penicillin in Ophthalmology.—The dramatic eye-saving rôle of penicillin in war is reported to the *British Medical Journal* by Dr. G. T. Willoughby Cashell, squadron leader and ophthalmic specialist, RAF. He states that eyes are saved which would otherwise certainly have been lost through intra-ocular infection. Cases of acute conjunctivitis improved dramatically, and even instances of long-standing discharge or inflamed lids are cured within weeks. In five

out of six cases of ulcers of the cornea and infections following perforating injury, spread of the infection to all structures and tissues of the eyes was avoided.

It is of interest to note also that in the United States, twenty million units of penicillin have been made available to the Illinois State Department of Public Health by the National Research Council to use on a research basis for the treatment of newborn babies with ophthalmia. Although the silver nitrate law for the protection of babies' eyes has made ophthalmia rare in Illinois, about 30 newborn infants are hospitalized at state expense each year to prevent blindness from a type of ophthalmia that is contracted at birth from mothers infected with a veneral disease, the state health department reported. The 20 million units of penicillin which have been made available to the department is enough to treat 30 infants, it was stated.

New Journal to be Published.—The British Medical Society announces the publication, begining January, 1945, of the *British Journal of Industrial Medicine*. It is intended that this will serve as an outlet for an expanding body of research into economic, physiological, psychological, and safety problems facing management, workers, and industrial physicians.

Dr. Donald Hunter of the London Hospital is proposed as editor-in-chief, with an editorial board comprised of Drs. A. J. Amor, M. W. Goldblatt, D. C. Norris, Donald Stewart and Mr. R. W. Watson-Jones, a surgeon.

The Mexico Association for the Prevention of Blindness.—Volume I (1943) of the *Archivos de la Asociacion para Evitar la Ceguera en Mexico* (Gomez Farias No. 19, Mexico D.F.)celebrates the twenty-fifth anniversary of the Association, whose Director is Dr. L. Sanchez Bulnes. Its history and achievements are recounted by Drs. Gustavo Baz, Cesar R. Margain, and Daniel and Fernando Silva. The volume contains also articles on ophthalmologic subjects.

Volume II (1944), continuing this policy, includes several articles by doctors of the U.S.A.—Drs. William Thornwall Davis, John N. Evans, Ramôn Castroviejo, Daniel B. Kirby, Martin I. Green,

Marc Amsler, Ray K. Daily, Arthur J. Bedell. Volume II carries English summaries of many articles.

Sight-Saving Class in Australia.—The Royal Victorian Institute for the Blind of Melbourne, Australia, gives aid to the classes for partially seeing children. We quote from the 1943 Annual Report of the Institute: "In its special class for myopic and partially-sighted children, the Education Department continues to use our books in large-sized print. We also placed at its disposal a special large-type typewriter which enabled stencils to be cut for the production of books for their classes. As it was found almost impossible to import large-type books, the typewriter has more than proved its worth."

Dr. Sawyer Appointed to UNRRA.—Dr. Wilbur A. Sawyer of New York has been appointed Director of Health of the United Nations Relief and Rehabilitation Administration. He has been assigned to Washington and will be in charge of the Health Division of UNRRA and be responsible for planning and directing health and medical activities. His duties will require frequent visits abroad to the regional offices, and field work.

Dr. Sawyer has had long experience in international health activities through his connection with the Rockefeller Foundation's International Health Division, of which he has been Director for the past nine years. Before the First World War, in which he served as Major in the Medical Corps of the Army, he held positions in California as Director of the State Hygienic Laboratory, Secretary and Executive Officer of the State Board of Health, and Clinical Professor of Hygiene and Preventive Medicine in the University of California. During the present war, Dr. Sawyer has served as member of the Subcommittee on Tropical Diseases under the Board of the Investigation of Epidemic Diseases in the Army, and as Honorary Consultant to the Medical Department of the Navy.

Wins Prize for Glaucoma Paper.—The Moura Brazil Prize for 1943 was won by Dr. Sylvio de Abreu Fialho of Rio de Janeiro with a paper on "Contribution to the Problem of the Diagnosis of Early Glaucoma."

Oxford Ophthalmological Congress.—Despite the distractions and difficulties occasioned by the War, the Oxford Ophthalmological Congress held its 30th Annual Meeting on July 6 and 7 at Oxford University. The Doyne Memorial Lecture was delivered by Professor Geoffrey Jefferson.

Charles H. May, M.D., 1861-1943.—Workers in prevention of blindness have lost a true friend in the death of Dr. Charles H. May. Though not all may have had the privilege of knowing him personally, they have received his invaluable assistance through their constant use of his book, *Manual of the Diseases of the Eye.* Writing in the *Archives of Ophthalmology*, of Dr. May's authorship of the book, Dr. Charles A. Perera, who knew him intimately as a close associate, and in later years, as assistant in preparing the book, says:

"In the field of medical writing Dr. May was a master. His most widely known work is his *Manual of the Diseases of the Eye*, which has gone through eighteen editions since 1900. . . . This book is in wide use as a textbook for medical students and general practitioners of medicine, and it has been translated into many foreign languages, the most recent one being the Portuguese. To Dr. May his textbook was a real child. He read the ophthalmologic literature assiduously, ever seeking to keep his book up-to-date. Just two weeks before his death, he insisted on completing the corrections of proof of the eighteenth edition of his brain child. . . .

"In handling patients he was without a peer. He knew when to reassure, when to be sympathetic and when to be firm. Patients with a hopeless prognosis were given a feeling of courage by his words.

"Like all great men, his kind and generous deeds were hidden. No one who sought his help was turned away."

The loss of Dr. May as an ophthalmologist, as a teacher, as a humane and generous person is irreparable, but some comfort and consolation can be sustained in the thought that his works go on, and his written word and teaching will continue to serve all those who are striving to conserve vision and prevent blindness.

Current Articles of Interest

Moto-Kinaesthetic Speech Training Applied to Visually Handicapped Children, Sara Stinchfield-Hawk, Ph.D. *Outlook for the Blind*, January, 1944, published monthly by the American Foundation for the Blind, Inc., 15 West 16th Street, New York 11, N. Y.

Premising that there is a larger percentage of speech defects among visually handicapped children and that prognosis is less favorable than among an unselected group, Dr. Stinchfield-Hawk proceeds to indicate the effectiveness of moto-kinaesthetic speech training among the partially seeing. Kinaesthesis operates in two ways: children can feel with their own hands the movements of the teacher's speech musculature as she talks; and they can learn by feeling, the shape, size and texture of objects.

Treatment of speech defects by this method will do much to effect the mental catharsis which adjusts the visually handicapped as poised, self-reliant members of society.

The Basis of Night Vision, G. L. Walls. *Illuminating Engineering*, February, 1944, published monthly by the Illuminating Engineering Society, 51 Madison Avenue, New York 10, N. Y.

Mr. Walls minutely describes the physiological process of dark adaptation, whose threshold, speed and final effectiveness vary greatly among individuals.

The causes of ineffective adaptation — principally vitamin-A deficiency or inadequate vitamin utilization—are discussed, as well as methods of lowering the threshold of adaptation—overventilation (rapid breathing) or breathing air of higher-than-ordinary oxygen content, which produce only momentary response; dietary manipulation; application of mild stimuli to other sense organs; and use of red goggles.

Mr. Walls briefly summarizes scientific opinion as to the relationship between pigmentation and the dark-adaptation threshold, and as to optimum outdoor illumination under blackout conditions.

Protect Young Eyes, H. Wallace Lane. *Hygeia*, April, 1944, published monthly by the American Medical Association, 535 N. Dearborn Street, Chicago 10, Ill.

Parents are again warned of the insidious onset of amblyopia—loss of vision in one eye. This occurs when, the eyes not focussing naturally together, the child finally gives up the effort of forcing them to look at a single object, and simply sees with one eye until the other weakens from disuse.

Tendency toward amblyopia is hereditary, but its development can be avoided by watchfulness and treatment during the preschool years. Lack of vigilance and carelessness about securing treatment will throughout life limit the amblyope's recreation and choice of vocation.

Newer Concepts of Eyestrain, Edgar E. Poos, M.D., F.A.C.S. *Eye, Ear, Nose and Throat Monthly*, March, 1944, published monthly by The Professional Press, Inc., 5 N. Wabash Avenue, Chicago 2, Ill.

Dr. Poos states that eyestrain is a very prevalent symptom which often is a reflection of the patient's general condition. Diagnosis depends upon the history, and therapy includes correction of visual errors, exercises and attention to the patient's general health.

Partially Seeing Children, Winifred Hathaway. Part III of A Decade of Progress in Special Education. *Journal of Exceptional Children*, May, 1944, published monthly during the school year by the International Council for Exceptional Children, Saranac, Michigan.

Although a decade is an exceedingly short period in the life of an educational movement, a foundation has been laid for the care of partially seeing children. Comparative figures regarding sight-saving classes at the beginning, and at the end, of the last decade, are cited: Number of classes, 428 to 629; locales, 127 cities in 23 states, to 221 cities in 31 states or territories; children accommodated, 7,000 to 9,000.

Mrs. Hathaway reports encouraging progress in educational procedure and attitudes; physical plants; legislation; medical pro-

vision; and special contributions in procedure or teacher-training, which point the way for even greater progress in decades to come.

Certain Virus Diseases of the Eye, S. Hanford McKee, M.D., F.R.C.S. (C). *The Canadian Medical Association Journal*, March, 1944, published monthly by The Canadian Medical Association, 3640 University Street, Montreal, Quebec.

The distinguishing properties of viruses are, that they are parasites unable to multiply apart from living cells; they are able to pass filters which retain all ordinary bacteria; and most of them produce inclusion bodies in susceptible cells. A number of the viruses are of ocular importance, and Dr. McKee discusses in detail the etiology and treatment of lesions of eye diseases caused by viruses, principally trachoma and kerato-conjunctivitis. (Inclusion conjunctivitis.)

Riboflavin and Vitamin A in Relation to "Eyestrain," Lionel Bradley Peet, Ph.D., M.D. *The Canadian Medical Association Journal*, October, 1943, published monthly by The Canadian Medical Association, 3640 University Street, Montreal, Quebec.

Dr. Peet reports observations made on 232 persons doing constant reading, under uniform conditions of the incidence of presumed deficiencies of vitamin A and of riboflavin. Treatment produced a small effect (12 per cent) by vitamin A, and a large (57 per cent) by riboflavin. The latter is offset by the large number (42 per cent) of diagnosed riboflavin deficiencies which cleared up without treatment, during three months. Among the remainder, subjective improvement in "eyestrain" was slightly more common than in the other groups. The importance of suitable controls thus receives new emphasis in the current discussion of this subject.

A Study of a Selected Group of Women Employed on Extremely Fine Work, Ida Mann, D.Sc., F.R.C.S. and Dorothy Archibald. *British Medical Journal*, March 18, 1944, published monthly by The British Medical Association, Tavistock Square, London W. C., England.

The ability to perform fine work depends on a number of factors, whose relative importance and essential degree were studied

by these Oxford fellows. The factors are: refraction, visual acuity, muscle balance, accommodative power, and psychological adjustment to the work. The experimental group consisted of 28 women, aged 15 to 40, employed on inspection of spiral filaments for light bulbs.

A full battery of tests shows that individuals capable of prolonged fine work without fatigue or other symptoms possess an extremely highly developed stereoscopic sense and muscle balance at the near point. The factors on which judgment of fitness for close work should be based appear to be (1) binocular balance; (2) refraction; and (3) psychological stability.

Diabetes and the Eye, Dr. Lawrence, before Royal Eye Hospital Clinical Society, July 16, 1943. *British Journal of Ophthalmology*, November, 1943, published monthly by The British Journal of Ophthalmology, Ltd., 24–27 Thayer Street, W. 1, London, England.

Dr. Lawrence outlines the diabetic defective metabolism, and the changes it makes in relation to the physiology of the eye. Of these changes—change in accommodation; dehydration; retrobulbar neuritis; diplopia; lens opacification; and retinitis—the last is one of the most to be feared, occurring often among the elderly.

Dr. Lawrence urges that ophthalmologists adopt the practice of testing urines and taking blood pressures to help them in reaching an accurate diagnosis.

Duties and Training of an Orthoptic Technician, Walter B. Lancaster, M.D. *American Journal of Ophthalmology*, May, 1944, published monthly by The Ophthalmic Publishing Co., 837 Carew Tower, Cincinnati, Ohio.

Dr. Lancester attempts to define the respective spheres of the ophthalmologist and orthoptist working together. It is the ophthalmologist's duty to make the diagnosis and plan to supervise the treatment. He should report to the orthoptist, ophthalmoscopic findings, visual acuity, refraction, deviations, history; then the orthoptist further diagnoses the case from the standpoint of intelligence and co-operative ability of the patient, and handles the details of orthoptic training. Dr. Lancaster discusses, with a light touch, the question of relationship between the two co-workers.

The orthoptist's best pre-training background is perhaps teaching or work in psychology, since psychological and educational aspects are vital in orthoptics. Some anatomy is necessary; full knowledge of physiology, physiological optics and psychology is important; but one need not have thorough grounding in optometry or medicine.

The Problem of Night Vision, K. Kekcheev. *American Review of Soviet Medicine,* April, 1944, published monthly by the American-Soviet Medical Society, 30 Fifth Avenue, New York 11, N. Y.

The war has sharply divorced the problem of dark adaptation and sensitivity from its former scope of purely academic interest. Russian scientists, investigating means of speeding adaptation and intensifying night vision, concluded that stimulation of other organs induced changes in visual faculties as part of a diffuse autonomic reflex; that the thresholds of night vision varied with the pulse rate, blood pressure level, and respiration. The stimuli most effective proved to be cold (washing the face with cold water) and mild physical exertion. One application of the stimulus can increase night vision 30–50 per cent for 1½ hours, and accomplish adaptation within 5–6 minutes, in contrast with the 25–30 minutes required for normal spontaneous adaptation.

Orthoptics for the Infant Squinter, One to Four Years Old, Edith V. Roth. *American Journal of Ophthalmology,* January, 1944, published monthly by The Ophthalmic Publishing Co., 837 Carew Tower, Cincinnati, Ohio.

The infant is not capable of the mental concentration essential for effective orthoptic treatment, and too early active treatment may result in an enduring distaste for all orthoptic exercises. Milwaukee Children's Hospital tests young squinters for visual acuity, fixation, angle of squint, type of correspondence, fusion and stereopsis. Glasses and/or occlusion may be prescribed if they are considered necessary, but orthoptic exercises are deferred until the child reaches an age of co-operation.

Eye Problems in the Aged, Hendrie W. Grant, M.D. *Journal-Lancet,* June, 1944, published monthly by Lancet Publishing Co., 84 South Tenth Street, Minneapolis, Minn.

This discussion appears as part of a special geriatric issue of the *Journal-Lancet*. Age changes are described as both physiologic and pathologic, being hastened by many low-grade progressive toxemias which accentuate the normal aging of the tissues, and by the stress and tension of living, high living, and the shocks of illness and trauma. Dr. Grant summarizes age changes in the eye as being characterized by sclerosis of the vessels, hyalinization (deposit of hyalin tissue), fatty degeneration and infiltration; degeneration of the pigment epithelium, and colloid degeneration of the glass membrane. The most common causes of visual loss are cataract, glaucoma, and macula degeneration, the last being resistive to treatment.

Eye Injuries in Shipyards, Prepared in the Division of Industrial Hazards by Frank S. McElroy and Arthur L. Svenson. *Monthly Labor Review*, December, 1943, published monthly by the U. S. Department of Labor, Washington, D. C.

Eye injuries constitute more than one-fifth of disabling shipyard injuries; of these, flying particles are responsible for half. This percentage, however, includes only "no-lost-time" accidents. Shipyard work frequently presents several simultaneous hazards, each of which requires specific protection. Welder's flash in only one of six cases occurs from the worker's own arc, often occurring in employees doing entirely dissimilar work in the welder's vicinity.

The authors suggest three preventive measures which, if thoroughly applied, would prevent 75 per cent of eye injuries: (1) more extensive use of goggles by workers in hazardous operations and by those working nearby; (2) more extensive use of screens to shield workers other than operators; (3) segregation of eye-hazard occupations wherever possible. It is also stressed that availability of goggles is insufficient; that enforcement of their wearing is necessary.

Ophthalmia Neonatorum, Conrad Berens, M.D. *American Journal of Obstetrics and Gynecology*, June, 1944, published monthly by The C. V. Mosby Company, 3523–25 Pine Boulevard, St. Louis, as the official journal of fifteen local, state, and national obstetrical and gynecological societies.

Between the school years 1906-07 and 1941-42, percentage of children admitted to schools for the blind because of ophthalmia neonatorum dropped from 28.2 per cent to 5.6 per cent. The silver nitrate treatment is principally responsible.

The effectiveness of various silver compounds is discussed, and reports on recent use of sulfonamides summarized. Sulfonamides failing, penicillin, and then fever therapy, are tried.

Dr. Berens warns that once ophthalmia neonatorum has developed, even the best treatment leaves many blind, and urges safeguards: (1) prenatal prevention—diagnosis and treatment of infections in the prospective mother; (2) postnatal prevention—prophylaxis of the newborn's eyes; and (3) universal use of the most modern and effective methods of treatment.

Strabismus and Its Correction, Oscar B. Nugent, M.D., F.A.C.S., *The Eye, Ear, Nose and Throat Monthly*, April, 1944, published monthly by The Professional Press, Inc., 5 N. Wabash Avenue, Chicago, Ill.

Dr. Nugent opens with discussion of orthoptic treatment, recommending the affiliation with a technician to free the ophthalmologist for diagnosis and surgery. Then is described in detail the author's recessive operation, for which he cites the following advantages: (1) the operation is applicable to any form of ocular deviation in which a recession operation is indicated; (2) the eye can be readjusted on the second or third day after the muscles have recovered from the influence of the anaesthesia and the muscle tone is returned; (3) the technic is simple and uncomplicated; (4) no patch is placed over the eye, but the patient wears his glasses during convalescence; (5) the operation can be performed with the least amount of trauma; and (6) the results are good.

Book Reviews

Corneal Transplantation with Fresh, Conserved and Fixed Material (Experimental and Clinical Observations). S. I. Shershewskaya. Novosibirsk, 1940.

Corneal transplantation by which the opaque cornea is replaced by clear corneal tissue has restored the sight of many blind people and it is being used at present all over the world. The Russian ophthalmologist, Prof. Filatov, has done a great deal of work in this field. The book by Shershewskaya, Senior Assistant of the State Institute for post-graduate and clinical study in Novosibirsk, gives a most comprehensive and thorough review of the subject. She relates her experimental and clinical work on the possibility of taking and retaining of the transparency of formalinized 4 mm. wide corneal discs.

The first chapter gives a detailed history of keratoplasty starting with Reisinger's first report in 1842, Von Hippel's work on total leucoma, Zirma's famous case in 1907, Elshnig's work in the Prague clinic which served as the basis of keratoplasty all over the world. Elshnig performed 203 corneal transplantations in the years 1908 to 1930, with resulting transparent union of the transplant in 20 per cent. Filatov and his associates performed 455 corneal transplantations during the years 1922 to 1938; in 264 of these the conserved cornea from the cadaver was used and successful results were obtained in about 67 per cent. Castroviejo of the United States published his results of 80 human keratoplastics. Keratoplastic operations are performed at present in all leading eye hospitals of the Soviet Union.

Chapter two deals with a review of the present technic of keratoplasty, fixation of the transplant, complications of the operation, instruments used, partial penetrating, total keratoplasty and alloplasty (the use of an artificial cornea of inorganic material). The author gives a most complete description of methods used with drawings illustrating the operation and instruments used by Elshnig, Filatov, Thomas, Castroviejo, Kraupa, Lowenstein, Lolein, etc.

The keratoplastic material, the indications, the post-operative course and complications are discussed in the third, fourth and fifth chapters. The contraindications for the use of the cornea in the Soviet Union are: syphilis, miliary tuberculosis, septicemia, malignant tumors and diabetes, of the donor; the age, sex and type of blood of the donor are not important. Most favorable results were obtained when using the cadaver's corneae, conserved in whole or citrated blood of the donor at a temperature of 3° C. The time of conservation can be as long as 15 days, although the best time is considered to be not more than four to five days. The transplant is kept dry in Petri's dish with the epithelial surface upward. The interstitial keratitis and leucomas after scrofulous diseases are most favorable for successful keratoplasty, i.e. non-adherent leucoma, with a deep anterior chamber; normal intra-ocular tension, no inflammation of the eye and good physical condition are essential for good results.

The most troublesome complications are: the secondary opacification of the transplant, the appearance of scar tissue behind the transplant and glaucoma. The various methods of combating these complications are reviewed. Filatov obtained good results in treating the opaque transplant by additional keratoplasty about the transplant.

The sixth chapter is devoted to the histogenesis of keratoplasty. The review of the subject indicates that: (1)The cornea has the quality of regeneration; (2) the cornea belongs to transplantable tissues. The histological findings of the transplant by various authors are given. Saltzer's brilliant experiments of transplanting dead organic tissue, formalinized corneal discs and of other authors on regeneration of the cornea give two directions of the union of tissues: (1) A true transplantation with the individual change of the disc (Fuchs, Ascher, Elshnig, Filatov) and (2) that the transplant is slowly absorbed and gradually is substituted by the regenerated tissue of the host, thus the transplant only stimulates the surrounding corneal tissue to regeneration. (Saltzer, Ribbert, Thomas, Castroviejo).

Shershewskaya's own experimental findings are described in the seventh chapter. She undertook the study in order to verify Saltzer's experiments and used penetrating homoplastic corneae, and

the size of the corneal disc was 4 mm. instead of Saltzer's 2 mm. The enucleated rabbit's eye was kept for two days in a 4 per cent solution of formalin, then for four days in Ringer's solution. Thirty-seven operations were done on 37 rabbits, all transparent cornea; only in two was there leucoma after a thermic burn. The union took place in 12 cases, or in 32.2 per cent; of these, three transplants were transparent, one semitransparent and eight opaque. The time of observation was from 9 to 14 months. The low rate of taking was due partly to overcrowded conditions in the animal house as the operated rabbits were not isolated. The taking of the formalinized transplants indicates and confirms Saltzer's experiments that the transplant after a certain time is reabsorbed and is replaced by the young regenerated fibers of the host. The histopathologic findings and records of the operation, also photographs of the eyes, illustrate the experiments.

The eighth and last chapter is devoted to clinical observations. The author performed 35 keratoplasties on 32 patients; of these 24 were unfavorable (total or partial leucomas, faulty light projection and high intra-ocular tension, and the operation was done because of the pressing desire of the patients). Of the 11 favorable cases there were six transparent takings, four semitransparent and one opaque. The technic of the operation with the author's modifications, drawings, a number of tables and detailed histories are given.

Shershewskaya performed five transplantations with formalinized corneal discs and since it was the first attempt on human eyes (except Ascher's one unsuccessful case), she used three most hopeless cases and two with fair indications for keratoplasty. She obtained one opaque, two semitransparent, one transparent and, in the fifth, the transplant was lost. Thus her work with formalinized discs on animals and human eyes proved that taking of the transplant is possible, only the fixing liquid has to be less irritating than formalin, the use of formalinized corneal discs would solve the problem of the donor. The histologic examination of the discs in rabbits showed no definite border of the transplant as the stroma of the host would blend with the fibers of the transplant. The postoperative course with the fixed discs runs similar to the course of unfixed transplants.

—Olga Sitchevska, M.D.

THE READABILITY OF CERTAIN TYPE SIZES AND FORMS IN SIGHT-SAVING CLASSES. Harold J. McNally. New York: Bureau of Publications, Teachers College, Columbia University, 1943.

Mr. McNally's book represents an attempt scientifically to determine satisfactory type sizes and forms for the use of sight-saving class pupils. He defines readability as "the extent to which a given type size and form lends itself to being read with absence of visual effort." At the outset the author informs us that examination of physiological and ophthalmological research revealed no entirely satisfactory method of measuring visual fatigue. It would seem obvious that scientific evidence cannot be determined unless one begins with definite and positive criteria. However, the author draws particularly from Luckiesh and Moss, and justifies his selection of criteria—which were (1) involuntary eye-blink (2) reading speed and (3) visibility—as measured by the Luckiesh and Moss Visibility Meter.

One chapter, entitled "Conditions of the Experiment," tells us that seventy-two pupils from New York public schools were used. Tables describe the visual difficulty with Snellen and near-vision reading for each subject tested. Readability of 12–14–18 and 24–point type was tested; enlarged typewriter and machine duplicated materials were included, and a full description of testing conditions and methods is presented.

Another chapter presents the thesis and the author's use of "analysis of variance"—the experimental design developed by R. A. Fisher, which provides for the most satisfactory "estimate of error" yet developed.

Mr. McNally analyzes and interprets his findings, stating that they are not at all definite, and suggests several possible interpretations. He does believe, however, that the results of the study will not permit the conclusion that any one of the experimental types is preferable to any of the others. He bases this conclusion upon strict interpretation of statistical results. This is undoubtedly open to question, for in the same paragraph it is stated "that in spite of the lack of statistically significant difference, however, there is a *possibility* that, for the subjects used in this study, there are differences in the readability of the type forms investigated, but they were obscured by operations of some other factors or com-

binations of factors." Observation on the part of sight-saving class teachers and supervisors would incline toward the acceptance of the latter statment and not toward Mr. McNally's stated conclusion.

The final conclusion at which the author arrives is "that studies of readability cannot be conclusive until and unless some more valid and sensitive criterion of visual fatigue, or of visual effort expended is developed." For the reader anxious for new and helpful information concerning type sizes and forms which should be used for sight-saving classes the study is a disappointment, for it contributes no reliable scientific data.

GLADYS DUNLOP MATLOCK

Briefer Comment

THE SIGHT SAVER. C. J. Gerling. New York: Harvest House, 1943.

As the author himself states in his introduction, this book is intended "for general easy reference by the average person on matters pertaining to the eye, sight, and their care." Subjects are arranged alphabetically, under both technical and non-technical terms, so that the searcher is not turned away by lack of comprehension of the terminology. A comprehensive system of cross-references enables one to delve as far into a subject as he wishes.

INDUSTRIAL SAFETY. Roland P. Blake, Ed. New York: Prentice-Hall, 1943.

This volume is intended as a handbook for workers in all industries and does contain much information of immediate and practical value to the worker. However, it seems most appropriate for such specific workers as foremen and safety supervisors rather than for the ordinary machine operators. Management, as represented by these employees, will make the most intelligent use of it.

The safety engineer planning an eye protection program will find pertinent advice under the chapters, Circumstances Surrounding Accidents; Plant Inspection; Layout and Arrangement; Guarding of Metal-Working Machines; Methods of Promoting Safe Practice; The Safety Inventory; First Aid; and Personal Protective Equipment.

THE 1943 YEAR BOOK OF THE EYE, EAR, NOSE AND THROAT. Louis Bothman, M.D., and Samuel J. Crowe, M.D. Chicago: The Year Book Publishers, Inc. 1943.

This annual anthology of pertinent literature is a guide for the hurried practitioner. The index makes the contents readily accessible for reference, and the "practice quiz" which the editors report was very favorably received this year, is again an item.

THE WORLD AT MY FINGER TIPS. Karsten Ohnstad. New York: The Bobbs-Merrill Company, 1942. 348 p. ill.

Karsten Ohnstad began to lose his sight when he was sixteen. A year of treatments, operations, and false hopes intervened before the day when his doctor presented him with a card bearing the symbols of the Braille alphabet. In that year the boy talked to men with all types of eye injuries and diseases, and began to develop that zestful interest in people which was to carry him through his blindness.

Karsten's boyish sense of humor was tickled by the problems of getting about without the aid of sight, and his first sense of being cut off from normal people came when he found himself doing something ludicrous and no one laughed.

Many odd bits of information about the world of the blind are given. Although he was aware, for instance, that in 1940 cars, trains and airplanes were streamlined—he had run his hands over the lines of cars and of minature planes—in his dreams all of them appeared with the straight-up-and-down lines of 1927 models. And in spite of the fact that sensory stimulation was now predominantly auditory, his mental images remained visual, and mental images of color, form and pattern remained curiously sharp.

The World at My Finger Tips is an informative guidebook to the world of the sightless, as well as providing acquaintance with an appealing and gallant personality.

Contributors to This Issue

Eleanor Brown Merrill, as Executive Director of the National Society needs no introduction to REVIEW readers. As announced, she has recently been made President of the National Health Council.

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Nutrition and the Human Eye*

Russell M. Wilder, M.D.

THE author presents the effects of diet deficiencies on the eye, and "emphasizes the need for exploration of the rôle of chronic malnutrition in the causation of degenerative diseases."

MY father was distinguished as an ophthalmologist. My own interests for several years have centered in nutrition. The two fields overlap and it may not be inappropriate for this first William Hamlin Wilder Memorial Lecture to relate to the border zone in which both ophthalmology and nutrition are involved.

The subject matter concerning which I wish to speak is contentious in certain of its aspects. Some of those engaged in studies of nutritional deficiency, including several ophthalmologists, have been over-enthusiastic. Others, with self-satisfied skepticism, have closed their eyes to advances of importance. It is my intention first to review certain evidence that must not be neglected, then to engage in some conjecture, in the hope thereby of pointing out the need for more research.

The subject is of great importance now, when much depends on the visual acuity of those who stand guard on our battle fronts or who man our ships and airplanes. We must not fail to apply the knowledge that exists nor to develop new knowledge as rapidly as possible.

It should be recognized that a state of nutritional deficiency exists whenever the supply of an essential nutrient is less than is required to maintain conditions in the organism that are satisfactory with respect either to growth or to the metabolic activities dependent on that nutrient. The results, in sequence, of any such

* First William Hamlin Wilder Memorial Lecture, delivered at the Postgraduate Assembly on Nutrition in Wartime, November 18, 1943, and reprinted from the Proceedings of the Institute of Medicine of Chicago.

deficiency, are: diminished excretion of the substance in the urine, usually accompanied by its lowered concentration in the tissue fluids; depletion of the body's reservoirs; changes in function, as evidenced by abnormality either of growth or of stages in intermediary metabolism which depend on enzymes, themselves dependent on an adequate supply of the nutrient; microscopic changes in the tissues; and finally the abnormalities characteristic of what has heretofore alone been recognized as deficiency disease. These various stages may be passed successively with more or less rapidity, depending on the intensity and duration of the inadequacy in question. The acute, severe process quickly leads to abnormalities that are readily detected. The mild process, whether acute or chronic, may easily escape detection or lead to abnormalities which are not attributed to malnutrition.

Acute, severe deficiency conditions result from diets that are grossly inadequate. They also arise, however, as secondary manifestations in other diseases. For instance, certain symptoms and signs developing in the presence of cancer or of some other anatomic lesion of the gastro-intestinal tract, of a type which interferes with digestion or absorption, frequently can be related to the failure of absorption of one or several nutrients. Likewise deficiencies develop in the course of diseases in which fever is provoked or in the course of hyperthyroidism or some other disease which raises requirements beyond what can be satisfied by the best of diets. The number of these so-called conditioned states of malnutrition is more important than has been recognized. The contribution of malnutrition to the symptomatology of disease in general deserves much more attention than it has received.

Night Blindness

A conditioned deficiency which involved the eye was reported several years ago from the Mayo Clinic.[1] In this case a gastrocolic fistula, developing after an earlier operation on the stomach, permitted direct passage of food from the stomach to a distal segment of the bowel. Digestion and absorption were thereby interfered with. The excreta were filled with undigested fat, and under circumstances such as this the fat soluble vitamins, including the pre-

[1] Wilbur, D. L., and Eusterman, G. B.: J. A. M. A. 102: 364, 1934.

cursor of vitamin A, carotene, are lost with the fat. Night blindness developed in this case, but when the gastrocolic fistula was repaired so that the food again passed through the small intestines digestion and absorption were restored and the night blindness promptly disappeared.

Another type of conditioned deficiency of fat soluble vitamin A is recently arousing much concern. Mineral oil, which is so much used as a laxative and, still more unwisely, is sometimes used in so-called slenderizing salad dressings, dissolves the fat soluble vitamins in the bowel and interferes with their absorption. Since the rationing of fats, this oil, which requires no ration points, has been used in place of fat in frying potato chips and doughnuts, or even has been used in place of shortening in baked goods. However, numerous cases have been cited in the past, like the one reported by Dr. Jeans.[2] The deficient dark adaptation of his little patient could not be cured by large doses of fish liver oil rich in vitamin A. The child was taking mineral oil, and when this practice was stopped the vision promptly became normal.

An example of dietary inadequacy leading to night blindness is provided by a story told to Dr. W. L. Benedict by his ophthalmologist friend, Dr. O'Brien. Sitting in his office the doctor watched three men approaching. The one in the center was guided by the other two. A carefully taken history revealed nothing other than the fact that this man's vision had been failing for the past few months. The examination revealed nothing except a peculiar haze on each cornea; no signs of glaucoma, optic atrophy, or other obvious abnormality. Even use of the slitlamp disclosed nothing more than diffuse epithelial disturbance of the cornea. However, the thought of deficiency of vitamin A led to questioning about night blindness. The man had noticed poor vision on dull days in the house and when he fed the stock at dusk. His diet consisted of potatoes; no butter, eggs, meat, milk, or leafy green and yellow vegetables, just potatoes. The potatoes presumably were white, since sweet potatoes would have provided a source of carotene, the precursor of vitamin A. He agreed to drink a quart of milk a day, to eat large portions of butter, fresh vegetables, eggs, and fatty meat, and to take a daily dose of cod liver oil. Within a month the

[2] Minnesota Med. 16: 688, 1933.

vision was restored. Dr. O'Brien almost missed the diagnosis in this case. Vitamins, as he said, were in the background then and one would not suspect a vitamin deficiency in a prosperous farmer in the corn belt.

Nutritional night blindness has an old, extensive history. The Chinese knew of it in ancient times and treated it with liver, an excellent source of vitamin A.[3] Gross abnormality of this type is certainly not common in our country, and interpretation of the results of the multitude of technics and of the results of use of the many instruments which recently have been introduced for measuring lesser degrees of this condition, is a subject of dispute. Suggestive of the significance to industry of minor disturbances of this type is an observation quoted by Sherman,[4] that workmen receiving more vitamin A were more efficient in matching the whiteness of tiles. The relationship of mild degrees of vitamin A deficiency to the frequency of automobile accidents is probable although not as yet established, and disappointment has been expressed over the lack of benefit from administering this vitamin to the flyers in the Royal Air Force. The suggestion recently has been made that an as yet unidentified nutrient, present in fresh vegetables, is also necessary for good night vision. Soldiers in the Sudan, where the diet contained very little vegetable although liberal amounts of liver, eggs, and milk and thus enough vitamin A, were found to have abnormal dark adapted thresholds.[5]

Night blindness represents a disturbance of function. Visual purple, so-called rhodopsin, is the photoreceptor substance of the rods; visual violet, or iodopsin, is the photoreceptor of the cones. The sensitivity of the retina at any stage of adaptation is determined by the concentration of these receptor substances. They bleach on exposure to light, liberating vitamin A, and simultaneously the threshold for light is raised. In the dark, regeneration of these substances and of visual acuity is normally rapid. Vitamin A is thus regarded as a precursor as well as a product of the visual purple and violet substances, and on deprivation of this vitamin

[3] Lee, T'ao: Chinese M. J. 58: 314, 1940.

[4] The Science of Nutrition, New York, Columbia University Press, 1943.

[5] McCrae, T. F.: Squadron Leader R. A. F. report to Food and Nutrition Board, Oct. 22, 1943.

synthesis of the photoreceptor substances is inhibited,[6] with resulting slow return of vision after bleaching of the retina by light.

Nutritional disturbances of function of the type limited to chemical changes such as the synthesis of the photoreceptor substances of the retina usually respond to treatment rapidly, and, in point of fact, nutritional night blindness usually is corrected rapidly by administering vitamin A. This might lead to the conclusion that it represents a relatively mild deficiency condition and therefore be of fairly common occurrence. However, the body's stores of vitamin A are large, and for this reason experimental subjects who previously have been well supplied with vitamin A can be maintained for many months on diets very low in vitamin A without developing detectable night blindness.

Xerophthalmia

In xerophthalmia the cornea is thickened by hyperkeratosis. Softening follows, later ulceration, with resulting infection of the eyeball and loss of sight. This is the tissue lesion which long has been attributed to deficiency of vitamin A. It now is rarely seen in the United States or Europe, but formerly was not uncommonly encountered among pellagrins in the southern states. In the Orient and in certain parts of Africa it is commonly encountered now. Reports of 15 per cent of 4,000 school children with xerophthalmia in Bengal, of 83 per cent of certain groups of children in Tientsin, China, and of 65 per cent of the blindness of Ceylon being attributed to xerophthalmia are cited by Sebrell in his recent chapter of the "Handbook of Nutrition."[7] The relationship of vitamin A to this disease was established during the period of the first World War. McCollum and Davis,[8] in 1913, from the failure of rats to grow when they were deprived of certain lipoids, suspected the presence of a vitamin contained in fat. A year later Osborne and Mendel[9] noted inflammation in the eyes of animals when they were receiving diets deficient with respect to butter and other fats. Then came Bloch,[10] in Denmark, who studied children with xeroph-

[6] Wald, George: J. Physiol. 19: 351, 1935–1936.

[7] J. A. M. A. 123: 280, 342, 1943.

[8] J. Biol. Chem. 15: 167, 1913.

[9] Id. 17: 401, 1914.

[10] Ugesk. f. laeger: 79: 309, 349, 1917.

thalmia in the last World War. The Germans had been paying fancy prices for Danish butter and in consequence the Danish children were deprived of butter fat. Bloch was impressed with the striking efficiency of cod liver oil in the treatment of these patients, but it remained for McCollum and Simmonds[11] to provide the correct interpretation of the effect of the cod liver oil. "It is not true," they said, "that a fat starvation was responsible for the condition, but rather lack of the unidentified dietary factor, fat soluble A, which occurs in just those foodstuffs which have been observed to possess curative properties." In point of fact, the Danish children had not been seriously deprived of fat. They had substituted margarine for butter. The experience led to a Danish regulation requiring that all margarine be fortified with vitamin A. It accounts for the interest in fortification of margarine in our country at this time of butter shortage.

Thickening of the epithelium of the conjunctiva accompanies the hyperkeratosis of the cornea in xerophthalmia. According to the view held by Kruse, the conjunctival lesion may develop independently, especially if the deficiency of the vitamin is slight and the duration of the deficiency is long. I shall return to this again, after first reviewing other nutritional lesions of the eye which, being more acute, have received more general recognition.

Ariboflavinosis

The effects of deficiency of riboflavin are manifested early in the eye. The work of Bessey and Wolbach,[12] using the slitlamp *in vivo* and injection methods postmortem, demonstrated conclusively that lesions of the cornea developed in rats given a diet inadequate only in riboflavin. Vascularization was the earliest and most constant abnormality to be seen. Later leukocytic infiltration of the epithelium produced superficial and interstitial opacities. Moreover, cataract occurred inconstantly, as previously had been observed by others. The experimental lesions of the cornea were corrected by administering riboflavin, although the changes in the lens were not affected. The first clear evidence that lesions such as this may be found in man was brought by Kruse, Sydenstricker, Sebrell, and

[11] J. Biol. Chem. 32: 181, 1917.
[12] J. Exper. Med. 69: 1, 1939.

Cleckley.[13] Nine men and women receiving a deficient diet had ocular lesions associated with itching, burning, and a sensation of roughness in the lids. In five of these persons corneal opacities were grossly visible. In every case examination with the slitlamp revealed dilatation of the vessels encircling the limbus and invasion of the cornea by capillaries arising from the limbic plexus. The lesion was not benefited by giving thiamine, niacin, ascorbic acid, or vitamin A. It was corrected—"cured" was the word used in the report—by giving riboflavin, and relapse occurred on its withdrawal. The corneal lesions were accompanied by other signs of insufficiency of riboflavin, namely cheilosis, glossitis and seborrheic dermatitis, and these signs likewise progressed or receded in parallel with the discontinuance or administration respectively of riboflavin.

These authors later amplified their earlier report. The patients in eighteen of the added cases were institutional employees who supposedly had adequate diets and were considered to be well nourished. However, all but two complained of visual disturbances such as photophobia, diminution of vision, or eyestrain not relieved by glasses.

An important study bearing on this subject was reported this year by Tisdall, McCreary, and Pearce[14] of the Royal Canadian Air Force. The vitamin riboflavin is rapidly destroyed by light, and it seemed possible to these investigators that the men in their air crews, exposed to glare as they were for long periods of time, might be expected to require more riboflavin than was provided by their rations. Slitlamp examinations were made of the corneas of 198 of these men and some degree of abnormality was found in every case but one. The degree of change was designated as stage 3 in 93, or 46.9 per cent of the men examined. The lesion in this stage 3 was described as proliferation of the vessels of the limbic plexus and penetration of the cornea with twigs, streamers, and loops. Two of every three men with these lesions of stage 3 complained of two or more of the symptoms encountered in deficiency of riboflavin; symptoms such as tiredness of the eyes, aching and watering of the eyes, sandy sensation under lids, dizziness, headache, intolerance for reading, and decreased visual acuity.

[13] Pub. Health Rep. 55: 157, 1940.
[14] Canad. M. A. J. 49: 5, 1943.

A number of the men were given riboflavin, a comparable number received a placebo, and photographs of the eyes of all were made at intervals. Special equipment permitted large magnification and rapid exposure. The subsequent events were notable. Of the men who received placebos, 28.6 per cent were worse and significant improvement was observed in none; of those who received riboflavin, almost all obtained symptomatic improvement, and photographs revealed recession of the vascularity of the cornea. The recession was described as marked in more than two-thirds of all the men examined.

The rapidity of the response to treatment in the cases of these flyers suggests severe deficiency of relatively short duration. The severity of the deficiency is puzzling. Assays of the rations showed the average intake of riboflavin to be 1.6 mg. daily. This amount is well below the 2.7 mg. recommended as a daily allowance by the National Research Council, but a study conducted in the Mayo Clinic laboratories has suggested that the minimal requirement of this vitamin approximates only 0.5 mg. per 1,000 calories. Indeed, no ocular lesion was observed in a period of 290 days when the intake provided only 0.35 mg. per 1,000 calories. The subjects of our studies were not exposed to light nor were they under any physical or ocular strain, and from this it would appear that the flyers of the Royal Canadian Air Force who received approximately 0.5 mg. per 1,000 calories may have been obtaining enough riboflavin to protect them under ordinary circumstances but not enough for the conditions of their flying service. What factor increased their requirements is not as yet established. Recent studies supported by the National Research Council have not thus far supported the hypothesis that light, per se, affects requirements for riboflavin. Eyestrain possibly was the factor of importance. The search for submarines in which the airmen were engaged would involve long hours of visual strain. Other conditions of the environment also may have played a part.

Thiamine Deficiencies

Another state of acute deficiency which affects the eyes has been observed in Wernicke's disease. This usually, but by no means always, is encountered in alcoholic subjects. The syndrome, as

described by Jolliffe and his associates,[15] includes neuritis (peripheral polyneuropathy), varying paralyses of the muscles of the eye, clouding of consciousness, and ataxia. It also may include optic neuritis as in the first case to be described by Wernicke and in a fatal case reported from our clinic by Ecker and Woltman. Palsy of the sixth cranial nerve with resulting internal strabismus is regarded as an early manifestation. In cases of greater severity some of the muscles innervated by the third nerve are involved. The deficiencies represented in Wernicke's disease are usually multiple, but the palsied muscles of the eye respond with dramatic rapidity on giving thiamine.

In his discussion of the case of Wernicke's disease which Ecker and Woltman[16] reported, Wagener related observations at the Mayo Clinic of several cases of pernicious vomiting of pregnancy and of vomiting after abdominal or pelvic surgery. The patients were confused, their vision dimmed, the ocular muscles palsied, and hemorrhages and, in some cases, edema of the optic disks were observed on examination of the retina. The patients were rapidly restored when thiamine was given. The vision usually improved first, the paralysis of the muscles later. Wagener tells me that he sees such cases rarely now, since patients given glucose intravenously for vomiting in pregnancy or after operation are also, routinely, given thiamine.

Severe deficiency of thiamine, as has been demonstrated repeatedly in animals and more recently by my associates[17] in man, provokes bilateral peripheral neuropathies which resemble those observed in beriberi. The predominant effect is in the legs. The arms are palsied later when the involvement of the legs has extended to production of atrophy of muscles. Also found in cases of severe deficiency of thiamine are signs of involvement of the spinal cord, loss of vibratory sense, loss of knee jerks, and development of the Babinski sign. Sensation is affected. Numbness and tingling in the toes are early symptoms, plantar dysesthesia, and tenderness of the calves. Peripheral polyneuropathy, such as that described, has long

[15] Arch. Neurol. & Psychiat. 46: 569, 1941.

[16] Proc. Staff Meet., Mayo Clin., 14: 520, 1939.

[17] Williams, R. D., Mason, H. L., Power, M. H. and Wilder, R. M.: Arch. Int. Med. 71: 38, 1943.

received a recognized position among nutritional diseases. It represents severe deficiency disease, a tissue lesion of the nerves. Less well recognized are the symptoms of more chronic mild athiaminosis. Investigations, among them studies at the Mayo Clinic,[18, 19] have revealed that the primary abnormality in moderate deficiency of thiamine is one of function of the central nervous system. A syndrome develops which resembles neurasthenia. The subjects complain of lassitude and fatigue, of anorexia and dyspnea, of anginoid pain and palpitation. Objective signs are few at first. The amount of pyruvic acid in the blood, when glucose is administered, is abnormally elevated, an indication of disturbance in the metabolism. Occasionally some sugar is excreted in the urine—a pseudodiabetes. Alterations may be observed in the electrocardiogram and the motility of the bowel may be diminished. I regret now that we did not subject our subjects to tests of ocular accommodation. There is a problem here that calls for study. I strongly suspect that fatigue of the muscles of the eye will be found to accompany the other signs and symptoms of chronic, mild athiaminosis.

Chronic Malnutrition

Thus far in this review I have dealt with manifestations of nutritional deficiency which are relatively noncontentious. The incidence of most of these disturbances, like that of frank scurvy and rickets, is small. Their significance, therefore, from the standpoint of the health of the public at large is relatively unimportant. This is true at least for populations like those in most of the states of the United States, where abundant fresh vegetables, fruits, meat, and dairy products are relatively accessible to almost everyone. It is well to bear in mind, however, that almost every survey of what people actually eat has shown that the large majority of the diets of these better-fed populations fail to measure up in one or more particulars to the standards of nutritional requirements developed by the Food and Nutrition Board of the National Research Council. It is also well to bear in mind that while few people in this country are sick, very few are really well, and that the problem of the semi-well has been shown to be enormous by the number of registrants

[18] Williams, R. D., Mason, H. L., Wilder, R. M. and Smith, B. F.: Id. 66:785, 1940.
[19] Williams, R. D., Mason, H. L., Smith, B. F. and Wilder, R. M.: Id. 69: 721, 1942.

rejected by the army. According to the testimony given at hearings of the Committee on Military Affairs of the United States Senate,[20] not much more than half of all employables in the age group 18 to 37 years can be classified as physically fit for full military duty; for the age group 35 to 39 the percentage is but 30.7, less than one man in every three.

Life expectancy in this and other forward-looking countries has almost doubled in the last half century, owing largely to control of sanitation, but extending length of life does not alone imply creating a more healthy life. Indeed, it hasn't done so. We constantly are reminded of the rising incidence of what are called degenerative diseases, and almost every day are shocked to learn of someone, well known to us, who has died abruptly in middle age at the height of his productiveness. I find it impossible to avoid concluding that minor deviation from what has been called a satisfactory intake of one or another of the several essential nutrients plays a part of great importance in the picture of poor health. I therefore regard the next great responsibility of our profession to be extension of the concept of disease prevention to poor health prevention. Moreover, I am confident that this can be accomplished most effectively by an attack directed at nutrition.

In all discussions of nutritional disturbances it is important to distinguish clearly between acute and chronic processes, also to remember that deviation below the optimal intake in the case of any essential nutrient may be marked or only slight. All degrees of variation, both of intensity and duration, must be expected, and the effects of any deficiency will be further modified by capacities for adaptation, depending on individual differences of the persons affected. The importance of these distinctions has been pointed out by Kruse,[21] but thus far, except by very few, little thought or study has been directed to the chronic mild deficiencies. Kruse has emphasized that the lesions induced by mild chronic nutritional deficiency may not at all resemble those of early severe deficiencies, except as acute severe deficiencies may be superimposed on the conditions created by chronic deficiencies. It is not unusual, especially in

[20] Sanders, Lewis: Hearings before the Committee on Military Affairs, U. S. Senate, S. 666, Part 24, June 8 and 9, 1943, Table IX, p. 1167.

[21] Milbank Memorial Fund Quart. 20: 245, 1942.

pellagrins, to find acute lesions in combination with more chronic abnormalities.

Damage to tissues may be provoked by a variety of injuries, from the grossest forms of mechanical insult through poisonings of various kinds, many of them originating in bacteria or viruses, to deviation from the normal composition of the fluids which bathe the cells of the body. The blood and tissue fluids provide the internal environment, the *milieu interne* of Claude Bernard. A certain degree of fixity is characteristic of this *milieu interne*, as Bernard taught, yet changes do occur in it. Alteration of the amounts of hormone carried in the blood has profound and frequently dramatic effects on growth and on metabolism. Alteration in the amounts of the various nutrients which reach the tissues through this milieu has comparable effects.

Sherman's recent book "The Science of Nutrition" is recommended reading for those who hold too strongly to the view that vigor and longevity are predestined from conception. Sherman makes it clear that much of what is commonly called constitution and attributed to chromosomal endowment is owing to the body's internal environment which may be influenced for better or for worse through the food ingested. There is good reason to expect that long-term use of the guidance which the science of nutrition now offers can greatly ameliorate a large part of what passes for irreparable inadequacy, and that the level of health of many unhealthy adult people can be advanced to the status of more fortunate people supposedly born with better constitutions. There is even better reason to expect that the application of this knowledge to the maternal organism during pregnancy and its subsequent continued application to the child can prevent much of the type of disability which so commonly is diagnosed as constitutional inferiority and attributed to poor heredity.

Heredity itself may involve an element of nutrition, namely inheritance of good nutritional instincts. Sherman cited Hopkins as emphasizing this when speaking for both biological and chemical science as president of the Royal Society. Sherman also cited Dove as pointing out "that the 'innately superior' animal in a farm flock or herd thrives better in a given environment than do his fellows, largely because he is born with instincts which lead him to make a

better-than-average use of what the nutritional environment affords." In other words, the animal possessed of what is supposed to be an innate superiority thrives better than others in his herd, largely because he is born with instincts which lead him to select more advantageously than the others from the foods he finds available. His inborn superiority includes a superiority of nutritive instinct. One may see this manifest in children. Billie, more than a year younger than his 3-year-old brother Tom, puts Tom to shame at table by eating what is put before him. He especially likes his milk. In consequence Billie now weighs more than Tom and is more sturdy. However, if the animals possessed of what may be inferior food instincts are fed according to the example provided by the better feeders of the herd they do as well as those with better instincts. Likewise, as has been shown by the British milk-in-school scheme, the addition of milk to children's diets has supported better growth, better fitness, greater alertness of attitude, and buoyancy of spirits. An effect of added thiamine on learning has been demonstrated in a recent well-conducted study in an orphanage in Virginia. In every one of the 18 tasks on the program a vitamin-fed group of children surpassed a group not vitamin-fed in making gains, although the two groups were initially well matched. The content of thiamine in the diets of both groups of these children had previously averaged 0.9 mg., a daily intake which probably is no less than many persons usually obtain, but is less than optimal. The superiority of the vitamin-fed group varied among the measured activities from 7 per cent to 87 per cent, with an average improvement of 27 per cent.[22]

All who have had much to do with treating diabetes have seen diabetic children whose parents have continued to restrict the diet to a prescription received from the doctor when the child was very young. These children fail to grow or their growth is retarded. In such a case if the error is corrected soon enough growth will be resumed. If, however, the interval of time is long before the dietetic error is corrected, the individual remains a dwarf for life. It is not to be supposed that the inferiorities occasioned by long-term insufficiency of the supply of any nutrient essential for the maintenance

[22] Harrell, Ruth F.: Effect of Added Thiamine on Learning, New York, Bureau of Publications, Teachers' College, 1943.

of an optimal internal environment can be corrected overnight, or even after many months of treatment with massive doses of the nutrients which have been lacking. When compared to the effects of severe acute deficiencies, the damage to the tissues which results from an only slightly less than satisfactory composition of the internal environment is slow in developing. It also is slow to cure. It may or may not be reversible. If it is reversible the restoration may be incomplete and leave the tissues more vulnerable to later exposure to a poor diet. A group of active soldiers was given a ration suboptimal with respect to several vitamins during a period of vigorous physical exertion. Some of these men carried visible scars of past episodes of malnutrition. Those who did so, broke down much more rapidly than the men who from their histories had been better fed from childhood and were free from signs of previous nutritional disturbances. This greater vulnerability of tissues previously damaged by episodes of deficiency may well explain the greater vulnerability of the aged to nutritional deprivations. In a current study, two groups of men received a diet constructed to be borderline with respect to thiamine and other vitamins of the B complex. After three months of this regimen one group, composed of individuals more than 60 years of age, showed clear-cut signs of lack of thiamine. The group composed of younger men did not reveal these signs, although in both groups saturation tests showed marked deprivation of the tissue stores of thiamine.

The principal benefactors of the scientific knowledge of nutrition will be the children. The damage done by bad food habits by the time that adult life is reached are probably extensive, with premature so-called senescence as the consequence. However, even in the aged, some degree of reversibility of effects of chronic malnutrition may be obtainable by long-time use of ample doses of certain nutrients. There is much dispute about the significance of the lesion of the conjunctiva which Kruse attributed to chronic deprivation of vitamin A. I referred to this before when discussing xerophthalmia, and stated that this lesion of the conjunctiva might occur independently of the lesions of the cornea of xerophthalmia.

Normally the human sclera is a pale blueish white coat covered with a transparent thin layer of conjunctiva. Deficiency of vitamin A, according to Kruse, results in loss of the transparency of the

conjunctiva, lack of luster, followed by irregular thickening and increase in vascularity. The thickening is most marked in the equators of the eyes on either side of the cornea. In its more advanced stages it is called a Bitot spot, after Bitot who described it in persons suffering with night blindness. As the lesion progresses it involves more and more of the white of the eye and is accompanied by swelling and injection of the caruncle and the plica. Wiehl and Kruse[23] found a high per cent of the pupils in a public high school and many WPA employees having some degree of abnormality of this type. Jolliffe[24] found such conjunctival abnormalities in a very high percentage of all the patients admitted to the wards of the psychiatric division of Bellevue Hospital.

Kruse's interpretation of this conjunctival lesion has been seriously questioned.[25] The abnormality is looked on by many as a so-called natural consequence of aging. The difference in the point of view is less important, to my way of thinking, than the fact that after many months of administration of vitamin A, given as a specific therapy in high doses, these lesions of the conjunctiva may nearly disappear. Also significant, as Kruse has pointed out, is the fact that not all elderly persons show these lesions, and, on the other hand, that they may be found in children.

Another lesion of the eye which Dr. Wagener tells me is commonly attributed to senility by ophthalmologists is colloid degeneration of the choroid. It is commonly encountered in the aged, but is also often seen in younger persons of the type who frequently receive the diagnosis of constitutional inferiority. Massing in the macula of deposits of this type interferes with central vision and is then described as senile central choroiditis. The possible nutritional significance of this lesion has been pointed out by Yudkin.[26]

To attribute tissue lesions to senility seems to me like shirking a professional responsibility. Call a lesion senile if you will, but not a lesion of senility. Senescence is a product of tissue damage, not a cause. When the culture medium is regularly renewed *in vitro* tissue

[23] Milbank Memorial Fund Quart. 19: 241, 1941.

[24] Nutrition and the Deficiency Diseases. In: New York Academy of Medicine. Committee on Public Health Relations: Preventive Medicine in Modern Practice, New York, Paul B. Hoeber, Inc., 1942.

[25] Berliner, M. L.: Am. J. Ophth. 22: 32, 1942.

[26] Arch. Ophth. 23: 60, 1940.

cultures do not become senescent. These cultures in an optimal controlled environment are immortal. Degenerative lesions are encountered more commonly among older men and women because with age more time has been involved, time in which to suffer from the ill effects of uncontrolled environments. Time, however, does not start the changes. It is rather a dimension, as Kruse expresses it, over which effects, resulting from injurious environments, may accumulate and progress.

In connection with the part played by the nutritional environment in provoking changes in human tissues it is pertinent to recall the amazing improvement frequently observed in cases of cirrhosis of the liver in which treatment, as is now a common practice, has been by dietetic measures. These patients receive a diet rich in carbohydrate, liberal amounts of casein, and supplementary doses of vitamins—the B complex, ascorbic acid, and vitamins A and K. Which of the nutrients used is responsible for improvement in these cases is as yet not known, but the fact that this disease responds as it does provokes the suggestion that nutritional deficiencies have contributed importantly to its development. In point of fact, cirrhosis of the liver can be induced experimentally in animals by restricting certain nutrients.

Few persons at all times throughout life have received diets that are adequate in all particulars. Moreover, as I said earlier, states of malnutrition may be conditioned by infections as well as by other diseases which either increase the requirement for nutrients or disturb their absorption from the intestinal tract. They likewise may be conditioned by alcohol, by overwork, even by overeating. Opportunity for recovery from these conditioned episodes of nutritional deficiency is given to few persons for the simple reason that convalescence from disease is rarely scrutinized from the standpoint of nutrition. The longer a person lives the more time he has to accumulate the scars that necessarily must result from each such period of insufficient nourishment.

These inferences are strengthened greatly by the fact that what at long last is beginning to be recognized in man has been common knowledge with respect to animals for many years. Sherman, whose pioneering in this field is of great importance, has summarized the results of experiments in his and other laboratories. By improved

feeding colonies of rats have been developed in which the age span has been lengthened to what would almost represent an additional decade for a man. Furthermore, this added life has not been at the end of life but in the middle—a lengthening of the period of greatest vigor and vitality. This repeatedly has resulted from bettering not poor diets but diets which previously had supported growth and reproduction and were considered good. The opposite of this effect is seen in India where the average span of human life is limited to 27 years. Lack of sanitation plays a most important part in the shortened life span of the Indian, but sanitation is not alone the answer. The malnutrition in large areas of India is proverbial and malnutrition shortens life, both directly and by predisposing to infection. Also bearing on this subject is the difference in sickness and death rates in all countries between income groups. It is not heredity alone that contributes to the greater health and vigor of the so-called upper classes. The ability to purchase better diets plays a most important part. Good evidence of the reliability of this conclusion is the improved health record of the British in this war. Better average feeding, so effectively provided by the Ministry of Food, must account for this, since every other aspect of the health environment has been worsened. Every fifth house in London has been rendered uninhabitable by German bombings. Congestion is terrific. Crowds sleep in subways and other shelters against bombing, and every other doctor has been drafted for the army.

Plans for conservation of our natural resources must include provision for the adequate nutrition of the population. There is no greater waste in the world than that involved in raising a child through the many years of human youth and adolescence to have him die, as he does on the average in India, in the early years of his productiveness. It is almost equally wasteful to have him live, as so many of our people now live, in feeble health and unproductiveness. Improving diets can reduce this waste of human raw material. So obvious is the deduction from the mass of evidence now available as to make incomprehensible the attitude of the few who either pretend there is no problem of malnutrition, in what they call our well-fed population, or oppose the practical application of the knowledge that is now available. There is a tendency

among physicians to discount much of what has been learned by surveys of food consumption in samples of the population. This I think can be explained by their unfamiliarity with statistical procedure. There also is a tendency to discount much of what the laboratory rat has taught us, whereas in point of fact the rat in eating habits and digestive mechanisms is closer kin to man than is the dog. The misunderstanding of some of those exhibiting this attitude is abysmal. The following comment is an example. It is quoted from a book review recently printed in a medical journal: "Every physician who has ever seen women with *anorexia nervosa*, starved for years until they were down to 80 pounds in weight or less, must have wondered why they didn't develop the deficiency diseases which by all the rules of the game—for rats—they should have developed." In point of fact starvation is a way to cure deficiency diseases, both in rats and men, albeit such a cure may be worse than the disease. Deficiency of calories leaves nutritional lesions of its own making, although preventing or retarding the development of the lesions that result from lack of vitamins.

Conclusion

The bearing of these observations on the eye may seem remote, but obviously the eye, like other organs, is subject to the degenerative changes that accompany or provoke senescence, and if degenerative change can be retarded for the body as a whole, the eye assuredly will benefit. It, therefore, is not unreasonable to suppose that application to human diets of existing knowledge of nutrition, beginning soon in childhood and continuing through life, may delay the development of presbyopia or even prevent the development of lesions such as cataract. It may even be supposed that astigmatism, longsightedness, and shortsightedness will be found to be preventable by suitable attention to the nutrition of the maternal organism during the development of the eye of the embryo. These abnormalties result from minor imperfections of the size and contour of the cornea or of the eyeball, and it has long been known in animal husbandry that depriving cows of carotene gives rise to maldevelopment of the eyeballs of their calves. An incidence of cataract in rats maintained on diets lacking riboflavin has been demonstrated, as I have said. The investigators failed to cure the cataract by restoring

riboflavin, although the corneal opacities and other lesions resulting from restriction of riboflavin disappeared when riboflavin was again supplied. Prevention in the case of cataract may be all that is to be expected from improved nutrition. Other chronic lesions, like cirrhosis of the liver, will assuredly respond as has been shown.

It has been my purpose in the latter part of this discussion to emphasize the need for exploration of the rôle of chronic malnutrition in the causation of degenerative disease. The eye is an organ which lends itself to such investigation. It can be examined not only externally but internally, during life, like the stomach of Beaumont's famous Alexis St. Martin. Abnormalities develop in the eye in the course of most diseases of the type associated with so-called degeneration. The severe acute disturbances of nutrition are reflected by specific lesions in the eye, as has been seen, and it is not unreasonable to expect that further study will reveal reflections there of various types of chronic malnutrition. In this research the ophthalmologist should be able to contribute most importantly. The beams from his ophthalmoscope and slitlamp ought to light the path of human progress from poor to better health.

Future Goals for the Prevention of Blindness*

Eleanor Hearon

EMPHASIZES the need of co-ordinating and integrating prevention of blindness activities in each community; the training of eye workers; and the consideration of the problems of prevention of blindness on not only a national, but an international basis.

ANY goal for prevention of blindness must take into account the medical, social, and community aspects. In other words, this goal can be achieved through the medical field, community organization, and through case work to patients, implementing both the medical and the community attack.

Let us, in general, say that we must first hold to the gains that have been achieved in all of these areas. We must not limit our post-war planning to our own community, town, county, state, or even to the United States. Because of the increasing interdependence of and need for world planning, we shall have to extend horizons and consider prevention of blindness on an international scale. The gains that we have made in the medical field, in community organization, and in better care of the individual patient must be carried over to other communities who still have not as adequate facilities as we.

To reach one of the first goals we should consider the re-evaluation of the causes of blindness. Due to the increase of knowledge of the eyes and the advancement in the medical sciences there has been a shifting of causes of blindness.

Dr. Ralph Danielson in Denver estimates that the 70 per cent of the causes of blindness, which in the past could be laid to ophthalmia neonatorum, trachoma and syphilis, has so changed that

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at the present time these diseases will probably account for approximately only 5 per cent. The infectious disease and accidents which first accounted for much of the cause of blindness in persons up to 40 years of age has had a change because of better and more adequate health facilities and safety measures in industry. One of the physicians in Denver told me that in the early war days of accelerated industry, when manpower and production were the chief problems, the safety of the employee was not taken into account. During the building of Army posts in our vicinity they had often as many as 10 to 20 men in the office daily to have foreign bodies removed from their eyes. After the terrific rush of building was over and the industries were able to get on a more even keel and follow some of the better safety practices, these same doctors have not had more than one patient for the removal of a foreign body, for the past six months. Goggles are being required and the men are given more precautions as well as safety instructions.

The shortage of medical personnel throughout the country has given communities an opportunity to look into the adequacies of medical facilities and opportunities for medical care. The next few years will probably bring many changes in medical practice, and services will be developed which will increase the coverage, provide facilities, and extend the availability of medical services to the people throughout the whole United States. These measures will be in the area of public health social insurance, and also medical services. There will be an increase in preventive medicine, and one of the goals of prevention of blindness is to back and give support to this new field of medicine.

In addition there should be serious consideration to including in health examinations more extensive eye examinations and the use of ophthalmologists. It has been suggested that provocative tests for glaucoma and other potential dangerous eye diseases should be used in the physical examination processes and should be developed further through scientific research. Here again one of the goals should be the awareness of trends and the understanding of the need for extended medical services and the use of these resources in programs for prevention of blindness. To go on with consideration of some of the things which we might think about in re-evaluation in causes of blindness, let us turn from the infectious

types to the degenerative. Ophthalmology must tie in with a study of the eye phase of geriatrics. It has been said by those interested in this important field of medical care that to extend the period of life without making the increased years worth living and without offering a healthful active and happy existence to the old, is not meeting the problem.

Let us then think of what this will mean in terms of prevention of blindness emphases and activities. Cataracts, glaucoma, degenerative lesions, macular and fundus lesions of a degenerative nature must be given attention. New opportunities for prevention of blindness in the medical field will point toward research into the causes of degenerative diseases, methods further to determine focus of infection, and the location of that infection. In simple glaucoma, a degenerative disease, efforts should be made to find this in its incipient stages when it is far easier to treat either by myotics or surgery.

As was previously suggested, could not provocative tests be a part of the health examination of everyone over 40 years of age? In the degenerative types of causes of blindness, the ophthalmologist and the general man must co-operate. Good and adequate health examinations which are thorough enough to pick up nephritis, diabetes, and vascular changes, will serve definitely to prevent blindness.

Can we turn from the future to the present, for a moment? We have had an interesting project at the Colorado General Hospital, here in Denver, on preventive medicine. A preventive medicine clinic is set up as a part of the general clinics, and financed partially through the Junior League of Denver. This service is offered to medical students, nursing students, hospital employees, household workers, and it was also extended to two groups admitted on a group basis—the personnel of a local pipe and steel company and the employees of the Denver Orphan's Home. Other agencies have been urged to use this clinic for their clients who have no physical symptoms and who they think need a physical appraisal. The examination included a Wassermann test, urinalysis, full blood count, sedimentation rate, chest plate, and a most thorough physical examination. As far as the eye examination goes, we have been able to do tests for distant, near, and color perception, and the

internist has checked the eyes with an ophthalmoscope. We should like to have ophthalmologists available for a thorough eye examination and to do provocative tests for glaucoma, but this has not been achieved because of the pressure of work and the lack of medical personnel. However, we are aware of the need and when we are able to get a full ophthalmological staff again, we shall be ready to incorporate this again into our clinic. The present, then, often restricts our ability to carry out the ideal, but if we are aware of what can be done in the future and plan ahead, we can be ready to incorporate into our existing procedures new services which will give added service and will develop because we have been aware of the need for re-evaluation of the causes of blindness. This is just an example of holding on to the gains we have, and looking forward to future plans.

Ophthalmia neonatorum is an example of a disease in which treatment has become more efficacious and which might result eventually in a change even in prophylaxis. One of the physicians at home said that he was having to remove the eye of a small child who had 10 per cent silver nitrate at birth. In this doctor's practice he has had five cases in which children have lost their vision because of a mistake. The wax ampules have somewhat controlled the situation, but it is known that at times 10 per cent silver nitrate solution, which may be used for the mother's nipples, has been mistakenly used in the baby's eyes, instead of the one per cent solution. Again the stage of understanding and development in any area will point out new methods or trends in prevention; however, the value of mandatory use of silver nitrate has, in the recent past, and now, shown results by bringing about a decrease of blindness in babies.

Cataract comes under one of the degenerative conditions, which is thought to be on a vascular or nutritional basis. Again the method of prevention is to try and procure for each community more adequate facilities for general medical practice.

As a social worker, I probably should not be making this next statement but it really does bring out one of the goals. A physician recently told me that one method of aiding prevention of blindness of cataract is to have a certification system worked out which would prevent any man from doing cataract surgery who does not have the opportunity to do at least one cataract operation a

month or, as he said, once a week. The ophthalmologists themselves have taken the leadership in setting up standards for eye care and the gains which have been made must not be lost in any new program that is set up. Perhaps they too will go ahead recommending certification for cataract surgery, retinal detachments and some of the more intricate surgical operations. For example, early surgery by competent people is the answer in cases of retinal detachment.

We have all learned something through restricted speed limits and the physicians have seen a decrease in eye injury caused by automobile accidents, within the past two years. Perhaps we can learn something from this which could be continued in the future—not to save tires but to save eyes as well as life and limb.

We have covered a few of the problems which might be considered in a re-evaluation of the causes of blindness. Let us not forget that any prevention of blindness is a three-way problem and deals with ophthalmology and medicine, the patient and his reactions, and community organization. If we see the trend in the increasing life span, this should mean something to us in the care of the patient and in the field of community organization. Persons not only in ophthalmology will have to contribute their share to the field of geriatrics, but the doctor and the social worker will have to learn the problems of the older person, his personality pattern, and ways of dealing with him. This will be a challenge to us and will necessitate real study and learning if we are going to become equipped to deal with the problems of the person from 50–75, particularly those in the 60-75 age groups.

Again, from the community organization standpoint this has implications for development of medical services for this group as well as the development of preventive health examinations for the younger person, if we are to catch some of the difficulties which might be corrected early. We can no longer be casual about the care of the chronics but we must seriously concern ourselves with their problems. In how many areas is there a good preventive health program for the able-bodied, let alone for the chronic and the aged?

We have found in the past that prevention of blindness programs and activities do not just grow or happen, even though there are good public health facilities, industrial protections, and general

safety measures. We must, therefore, continue to believe in and to help develop some official central prevention of blindness agency or division to administer a prevention of blindness program that will co-ordinate the services, point out the lacks and gaps, and consciously integrate and direct prevention of blindness activities. Such a program means that there must be a general understanding of possible prevention of blindness measures; of what constitutes medical facilities and standards; of eye conditions; of the patient as a person; of case work skills; as well as a knowledge of sound community organization and a consideration of personnel and education.

Adequate personnel means that we must continue the gains we have made and the belief that persons who have superimposed upon their general professional equipment special training in the eye—whether it be in medicine, education or social service—do the job better. We should set as one goal the continuation of such courses as the National Society for the Prevention of Blindness has carried on in Washington University, St. Louis and in some of the teachers colleges, for sight-saving teachers. During this period we must prepare for the workers who are needed now and will be needed in the future.

As was said earlier, our job is not just one restricted to the United States. We must again begin to think of prevention on an international scale. We should, therefore, make these facilities available to people of other nations so that they may take back to their countries a knowledge of some of the gains we have made. If one looks at general health education training programs, one sees about the same percentage of attention paid to eyes as is often found in the training of nurses and doctors as under-graduates. We must see that schools which are now preparing people for health education incorporate more eye knowledge and prevention of blindness in their curricula.

The last point which I should like to bring up is one of interpretation. If we have health education, if we have more adequately trained personnel and a central governmental agency to concentrate on prevention of blindness—do we not yet have a problem of further interpreting the skills of the specially trained to medical and public health agencies and medical staffs? How are we to do this?

Perhaps we should take advantage of one of the tragedies of this war—the young men blinded in battle, and the civilians who lost their sight in bombings. Their plight alone should give an impetus to the prevention of blindness activities, especially as the general population will begin to realize some of the personal, social and economic problems of a person who has no vision. This may stir interest in activities which can be directed toward the removal of the causes of preventable blindness. I am told that after the last war, prevention activities received such an impetus.

Medical administrators are often interested in costs and in savings. Good case work services to patients in an eye service tied in with better community planning will be a saving to the patient, to the hospital, and to the community.

In these days of shortages we realize that prompt and effective treatment which is carried out as long as necessary will save time and effort of clinic physicians and the over-worked staffs. We shall have from the rehabilitation services estimates of costs of training of the blind, and this again will give us data which will help us interpret the needs for prevention. Hospitals and hospital administrators are becoming increasingly community minded and are beginning to see their interests as a part of the community picture. By case illustrations and by continual interpretation we can help integrate the needs for medical social service in eye clinics and in eye programs. However, there is nothing which is more efficacious than a job well done and a demonstration to the medical staff of the values to the patients and to the eye service of casework service. One goal, therefore, should be the continuation, on a demonstration basis, of specialized projects in eye services both in public health and in medical care services.

As you can see we have not presented revolutionary ideas, for much of the world's gains are made by setting goals and plodding toward them.

To review, then, the goals we can set before us in the future, we first must re-evaluate the causes of blindness, take heed of these, see the implications in terms of the patient, medical emphasis and treatment, and community organization.

We must continue to work toward the establishment of some means of co-ordinating and integrating the prevention of blindness

activities in each community; we must look into our community planning and organization and see that we utilize existing resources, point out the needs for others and help develop needed resources.

We must continue the training of eye workers and see that in their training we incorporate some of the problems of geriatrics, both medical and psychological.

Let us also remember that as in public health we can no longer be locally minded. Let us widen our horizons to think of the needs and of the problems of prevention on an international basis.

Improving the Visibility of Industrial Tasks

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THE author discusses the rôle of lighting in industrial efficiency.

EACH of the professions represented in the Seminar on the Industrial Aspects of Ophthalmology has its own particular jargon. The illuminating engineering profession is not an exception. The idea of using terminology which has very definite meaning offers a more exact mode of translating a thought from one member of a profession to others of the same profession who are familiar with the meaning and connotations of the words used. On the other hand, when a number of professions make common cause in order to achieve a result far greater than could be obtained by any one of them alone, the different professional languages may hinder progress unless great pains are taken to define and explain as the subjects are developed.

Each profession probably believes that it makes the major contribution to the cause of better industrial seeing. Again the illuminating engineer is not an exception because without light there is no seeing by any one, while there appear to be many who maintain a degree of vision satisfactory for their purposes throughout life without assistance. However, since light and sight are to vision what air and sustenance are to life, the question of which is the more important is rather academic. It is enough to say that brightness, brightness contrast, and brightness ratios are tremendously important factors in the complex process of seeing. Since it is evident that the vernacular will out, a start had best be made with a number of appropriate definitions.

Lumens

The light output of practically all lamps (light sources) which are used for lighting work-world seeing tasks is expressed in terms of lumens.[1] The technical definition of a lumen is not particularly complex; however, it is sufficient only to know that the light output of a 100-watt Mazda C (tungsten-filament) lamp, for instance, is 1,600 lumens—or 1,600 units of luminous flux. The light output of a 40-watt daylight Mazda F (fluorescent) lamp is 1,800 lumens. A 500-watt Mazda C lamp has a luminous flux output of 10,000 lumens while the luminous flux emitted by a 3,000-watt mercury lamp is 120,000 lumens.

Illuminating engineering is quite a simple profession fundamentally. The job is merely to utilize the lumens from the lamp on work surfaces and surroundings to maximum advantage.

Footcandles

Probably the footcandle[1] is the unit about which the most has been heard—though often this unit is referred to as foot candle power, feet candle, feets candles, etc. The footcandle is a measure of the density of the luminous flux incident upon a surface. Thus a lamp emits lumens; if the lumens from the lamp are controlled so that there is a density on the working surface of 100 lumens per square foot, an illumination of 100 footcandles results. That is, a luminous flux density of one lumen per square foot produces one footcandle.

Footcandles are measured quite simply with light meters. It has always been a relatively simple matter to measure footcandles and hence unfortunately this unit has been used almost exclusively in illumination design work. This is unfortunate because our ability to see an object is controlled by the light coming *from* it and its surroundings. That is, our ability to see this page is governed by the light it reflects or by its brightness.

Brightness

Brightness[1] is the expression of luminous intensity. In order for an object to be seen, it must be luminous—whether it reflects the light or emits it. For instance, the luminous intensity, or brightness

of a wall, may be low, while the luminous intensity or brightness of a bare lamp is relatively high.

Footlamberts

The footlambert[1] is the modern unit of brightness. If a surface emits or reflects light at the rate of 100 lumens per square foot, the brightness of the surface is 100 footlamberts. That is, the brightness of a body emitting or reflecting light diffusely at the rate of one lumen per square foot is one footlambert. The brightness of the 100-watt Mazda C lamp is over 50,000 footlamberts. The brightness of the 40-watt daylight Mazda F lamp is approximately 1,500 footlamberts.

Brightnesses are measured by means of suitable instruments. One of the better instruments costs fifteen to twenty times what one commonly used light meter does and requires considerable "know how" to be used intelligently. These are reasons why measuring footcandles is a more popular pastime than measuring footlamberts. However, the future of lighting lies in a full acquaintanceship with footlamberts, and more and more use will be made of brightness meters; therefore, there will be developments leading to lower instrument costs.

Footcandles (lumens falling on a surface) and footlamberts (lumens reflected by the surface) are related by taking the reflection factor of the surface into account. For instance, the quantity of luminous flux incident on this page is practically uniform and yet the brightnesses of the paper and the printing are quite different, because of different reflection factors.

Visibility

When an object is capable of being seen it is visible. When it is capable of being seen well, it is said to have a high visibility. In general the purpose of bringing the lumens from the lamp to produce footcandles on the work (which in turn result in a brightness of the work) is to achieve good visibility. The visibility of an object can be measured by means of an instrument which is called simply a Visibility Meter.

Eye Comfort

It is quite possible to have a high visibility and still not have eye comfort. As a matter of fact, some objects retain a relatively high visibility even when a glare source such as a bare lamp is well within the line of vision—producing a most uncomfortable seeing condition.

Revealing Brightness Contrast and Disturbing Brightness Ratios

Since the solution of industrial seeing problems will be largely by means of brightness engineering,[2] it is necessary to understand fully the sometimes confusing relationships of various brightnesses in the visual field. The matter may be confusing because in one case a high brightness difference will reveal an object while in the other case it will be disturbing to the observer and may conceal the object.

The brightness difference between critical detail and its immediate background which reveals the object is called *brightness contrast.*[1, 2] Since the black letters on this page are much more visible than white letters would be, it is obvious that it is desirable to have a high brightness contrast for easy seeing. Since a high brightness contrast contributes materially to the visibility of an object, for clarity this type of brightness difference can be referred to as *revealing brightness contrast.*

Revealing brightness contrast can be expressed simply as a ratio of the brightness of the critical detail to the brightness of its background. A better interpretation of the influence of contrast on visibility is given, however, when revealing brightness contrast is expressed as "per cent contrast." This is the ratio of the brightness difference between an object and its background to the brightness of the background. Perfectly black print on a perfectly white paper would represent 100 per cent contrast.* Perfectly white print on perfectly white paper or perfectly black print on perfectly black paper would represent 0 per cent contrast.

The brightness difference between the visual task† and its sur-

* $\frac{100 - 0}{100} \times 100 = 100$ per cent

† Composed of the critical detail and its immediate background.

roundings which conceals an object, or is disturbing, is called *brightness ratio*.[1, 2] Brightness ratio is simply the ratio of the brightnesses of any two surfaces. Generally, brightness ratio refers to the ratio of the average brightness of the visual task to that of some surface in the surroundings. For instance, with overly bright luminaires in the field of view there are high brightness ratios between the brightness of the work and the brightness of other surfaces in the surroundings. Low brightness ratios are conducive to high visibility and eye comfort. High brightness ratios in the field of view may reduce visibility and will almost certainly reduce eye comfort. For greater clarity brightness differences of this type can, therefore, be referred to as *disturbing brightness ratios*.

Four Factors Influencing the Visibility of an Object

There are a number of factors influencing the visibility of an object. Possibly the most obvious one is the size of the object expressed in terms of the visual angle which it subtends. While a 48-inch lamp may be relatively large in size for a viewing distance of 30 feet, when the lamp is five hundred yards away from the observer, its "size" becomes relatively small. Within certain limits increasing the size of an object increases its visibility.

Time is a considerable factor in seeing. If a wheel is held still, it can be seen quite easily. If it is rotated slowly, fairly accurate visual impressions can still be registered. However, if it is rotated rapidly, it is found that the visual snapshots are not made with sufficient rapidity to "stop" the action.

The brightness of the work is also a factor. Hence it is not uncommon for a person subconsciously to move toward the window when trying to see a difficult visual task. Since within the average office there may be only five to ten footcandles of artificial lighting with possibly over 100 footcandles at the window, a material increase in brightness is achieved by such a move.

The revealing brightness contrast of critical detail and its background is another factor which influences visibility, as has already been pointed out. Visibility is highest for a given set of conditions when the per cent contrast is at a maximum.

Considerable research has been devoted to determining the interrelationships of the four factors which have been mentioned. Since

in industry it is usually found that the size of the visual task is predetermined, that the time allotted for seeing should be a minimum and that the per cent contrast of the critical detail and its background is fixed, it is apparent that the influence most easily and most universally applicable to increasing the visibility of the task is brightness. Investigations by Luckiesh and Moss show that increasing brightness from .8 to 80 footlamberts increases visual acuity 70 per cent, contrast sensitivity 350 per cent and speed of seeing 230 per cent. These results are well corroborated by researches of Ferree and Rand,[4] Nutting[5] and Lythgoe and Tansley.[6]

Lythgoe[7] has carried studies of the influence of brightness on visual acuity as far as 1,000 footlamberts. His data show that acuteness of vision becomes progressively better up to this level. The data were taken with the brightness of the test patch and the brightness of the surroundings approximately equal, *i.e.*, disturbing brightness ratio at unity. This finding has been corroborated by Moon.[8]

Disturbing Brightness Ratios vs. Visibility

Another considerable influence on the visibility of an object is the ratio between the brightness of the work and the brightness of the surroundings. Continuing with Lythgoe,[7] it is found that when the surroundings are of a different brightness than the test patch, there are definite reductions in visual acuity. Lythgoe and Tansley[6] also show that high brightness ratios reduce the sensitivity to flicker—which is interpreted as meaning a reduction in the speed of seeing.

From the foregoing it is obvious that the matter of brightness engineering is much more important to high visibility than mere footcandle engineering. High footcandles with high or disturbing brightness ratios in the field of view is not a good solution to industrial seeing problems.

Factors Influencing Eye Comfort

In general, the factors influencing visibility also influence eye comfort. It appears, however, that some evaluation of eye comfort is a more valuable criterion of the severity of a visual task than is a measurement of visibility or visual acuity, because discomfort may be experienced before visibility is influenced. This is probably

because comfort includes the element of time—that is, the duration of the period to which the eye is exposed to the visual task.

For the most part, considerations of comfort have been in connection with disturbing brightness ratios in the field of view. One very common example of unfavorable brightness ratio is the all-too-common combination of white papers on dark desk tops. For instance, an office building was relighted from about 10 footcandles to 50 footcandles using well shielded fluorescent luminaires. Not long after the relighting was completed, one of the occupants complained that he had "too much light," or the light from the lamps was hurting his eyes, or something. Since some individuals work close to a window where there may be 300 footcandles (even without the sun shining in), we know that 50 footcandles is not "too much light" and we also know that the light from fluorescent lamps is not harmful to the eyes.[9] However, when an illuminating engineer placed himself at the desk of the individual, it was found that the disturbing brightness ratio between the white paper used and the black desk top was quite trying. Substituting a light linoleum for the black linoleum entirely eliminated all objections from this individual. Not long after, there was a similar case in the building and the same solution was equally effective.

These examples serve to illustrate another point which should be kept in mind, and that is, as brightnesses increase, the disturbing effects of unfavorable brightness ratios become more pronounced.[10]

High disturbing brightness ratios in the field of view require that the eyes go through the process of adapting[11] for the different brightnesses as the eyes follow a natural course throughout the field of view. The effort involved undoubtedly leads to fatigue and in no-wise contributes to the better performance of the visual task. If the eyes are normal, they can stand abuse surprisingly well. On the other hand, if the eyes are sub-normal and the seeing task is unnecessarily severe, the added eye fatigue may reasonably cumulate into a more serious condition. This may lead to general fatigue which could be the source of many industrial accidents.

Lighting and Production

For the majority of industrial tasks upper limits on production are established by the physical ability of the operator to co-ordinate

his movements with those of the process. Making the visual task easier by improving brightness, revealing brightness contrast and disturbing brightness ratios, however, results in a continued contribution to human reserves so that a greater factor of safety is present.

Even at best, attempts to ease visual tasks in industry cannot be 100 per cent successful because it is practically impossible to duplicate the conditions under which the eyes developed. Thus, most industrial tasks will probably be located closer to the near point instead of to the far point—or at distance; continued concentration will be required; the eyes will be used for much longer periods; and it will be quite some time before every one has artificial lighting equal to daylight. The purpose of this lecture is to assure that something can be done about this latter point, *i.e.*, the condition of insufficient indoor light can be taken and improved far beyond anything which has been done to date.

An indication that improving this condition not only has humanitarian aspects but influences production as well, has been found numerous times.[12, 13] It has been the general experience that lighting helps those who need help most. In other words, when there is an increase in the speed of working as a result of increased footcandles, the increase in speed of working of a slower group can be expected to be at a definitely higher rate than the increase in the speed of working of a faster group.

During the past decade, industrial lighting has benefited by a great deal of study and the introduction of types of light sources and lighting equipment which have made superior visibilities available for many industrial tasks. Probably the greatest advance in industrial lighting practice was made when fluorescent lamps were introduced. The use of these lamps has provided factories with large-area, relatively low-brightness sources for overhead general lighting which had been proven by previous studies to be highly desirable for use in industrial work. As a matter of fact, a quality of lighting was made available to the plants which was reasonably comparable to that which might be installed in an office area.

While the Mazda F lamp has revolutionized the concept of overhead lighting for industrial areas, it is quite possible that the major contribution which this illuminant will make to seeing in the in-

dustrial plant will be for close-up lighting. It has been stated that if the factory had been limited to a choice of fluorescent lighting either for overhead general lighting or for close-up (localized) lighting, the wisest selection would have been to use the F lamps for close-up lighting. This is because almost all close-up lighting utilizing Mazda C (tungsten filament) lamps results in a small reflector which becomes quite warm, specular reflections of high brightness, the possibility of high undesirable brightness ratios in the direct glare zone, a small area high-lighted, sharp shadows, etc. The equipment utilizing F lamps is much lower in brightness in the direct and reflected glare zones, provides a larger and more uniformly illuminated area (though possibly at a lower peak value) and results in shadows which are much softer.

It is not to be assumed, however, that the F lamps are a cure-all which can be used indiscriminately. The brightnesses of the lamps are sufficiently high to produce severe disturbing brightness ratios between the work and the light source when the light source is in the field of view of the workers. Investigation of the conditions leading to complaints about "too much light" or the light from the F lamps hurting the eyes will often uncover the fact that the worker is merely suffering from direct glare. Unless there are other unfavorable seeing conditions present, shielding the light source so that the worker cannot see the lamp will take care of the complaint.

Obviously it cannot be expected that all concerned with industrial seeing will become Illuminating Engineers; however, there are many common examples of poor lighting practice which all should learn to recognize. Fundamentally, deficiencies in lighting or seeing conditions in the factory will be due (1) to insufficient brightness of the work, (2) to low revealing brightness contrast between the critical detail being observed and its background, and (3) to high ratios between the brightness of the work and the brightness in the surroundings. The best way to uncover the sources of difficulty is to take a complaining individual's position and attempt to go through the same operations which he does—including eye movements. While doing this, the observer should be on the lookout for:

1. Insufficient brightness:
    a. Due to inadequate overhead illumination.
    b. Due to individual working in his shadow.
    c. Due to lack of needed close-up lighting.

2. Low revealing brightness-contrast between critical detail and its background:
    a. Where the critical detail of an object is seen in silhouette against another surface, the reflection factor of which can be varied to achieve an improved contrast with the object.
    b. Where the critical detail is integral with the object, so that its background cannot be treated separately. (In this case, a more revealing brightness contrast can often be achieved by the illuminating engineer through the use of directional lighting, large-area low brightness lighting or other devices with which he is familiar.)
3. High, disturbing brightness ratios between the work and its surroundings—usually resulting in a condition which is called "glaring" or which causes the individual to complain of "too much light," or the light hurting his eyes:
    a. Artificial light sources in the immediate field of view when looking at the work.
    b. Artificial light sources in the field of view as the eye follows a natural movement pattern while working.
    c. Bright windows in the field of view.
    d. Work brightly lighted, balance of room dark.
    e. Work in shadow or darker than surroundings.
    f. High ratios between brightness of work and brightness of other surfaces in surrounding.
    g. Reference material light and machines dark or vice versa.

There are more complex deficiencies, but the solution to most problems will be found among those enumerated above.

Summary

As the author visualizes the approach toward easing seeing conditions in the work world, it is three-fold.

1. To simplify the requirements for eye co-ordination, *i.e.*, to put the task where it can be seen easily.
2. To make the visibility of the task as high as possible, *i.e.*, by achieving proper brightnesses and revealing brightness contrasts and low brightness ratios; and

3. To fit the eyes to the task, *i.e.*, by selection and correction of eyes.

At the present time the three sources which can contribute are not too fully aware of the complexities and potentialities of their individual fields, much less aware of those of the others who have a mutual interest in the problem. It is enough at this time if each is aware of the contributions which the others can make so that when "a case" arises, we will be sure to avail ourselves of the specialized knowledge of the other groups in order that the work-world may be a better place in which to see.

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Rehabilitation in Relation to Sight Conservation

Dean A. Clark, M.D.

THE author discusses the relationship between the program for the utilization and conservation of eyesight in industry and the forthcoming rehabilitation program for war veterans.

AS is generally known, the Office of Vocational Rehabilitation is undertaking a program designed to implement the provisions of the Barden-LaFollette Vocational Rehabilitation Act Amendments that were passed July 6, 1943.

Rehabilitation is the last step in the chain of events of which prevention is first. It might be thought, therefore, that rehabilitation and prevention are rather far apart, but actually I think they are in spirit very close together. The one thing that the rehabilitation agency would like best of all would be to have nobody needing rehabilitation. When that happy day comes, we shall all be working for prevention.

Unfortunately, that day has not yet arrived, and we have a great many—the numbers are not too well known, but certainly in the millions—handicapped people in the United States, besides veterans, who are either unemployed, or very disadvantageously employed because of their handicaps. The Barden-LaFollette amendments to the Vocational Rehabilitation Act represent an attempt on the part of the Congress to do something about the rehabilitation of these individuals.

The Office of Vocational Rehabilitation is merely the federal agency which supervises the grants-in-aid to the states for this program, which is a federal-state program. It is actually operated by state rehabilitation agencies, which are under the State Boards for Vocational Education, and the State Agencies for the Blind.

The Vocational Rehabilitation Act has been in existence since 1920. It had a number of limitations such as, for example, the fact that there were no provisions for the use of federal funds for the rehabilitation of the mentally handicapped, no provisions for special services to the blind, and no provisions for the use of federal funds for physical restoration.

All those matters have been changed by the Barden-LaFollette amendments, as have the financial provisions. In general, under the amended law the federal aid is considerably increased. There is no longer a ceiling on the federal authorization, and the Federal Government now reimburses states 100 per cent for their necessary administration costs, as well as 50 per cent on case service costs. The total grant-in-aid from the Federal Government therefore amounts to about 60 per cent, or possibly two-thirds of all the money that will be spent on the rehabilitation of handicapped civilians.

There are special services for the blind, and federal funds are available for physical restoration, in addition to the services under the original law, which were vocational training, vocational guidance, placement in employment, and the provision of prosthetic appliances.

We have, therefore, two sets of problems, from the medical side. One is the problem of medical examination and treatment for those persons who require treatment for their handicaps, and the other, the suitable placement of handicapped persons in jobs. The jobs must be such that the disabled persons can do creditably in spite of their disabilities; and second, they must be jobs that will not make the disabilities worse or cause new disabilities.

Since these services are operated by the states, the Federal Office is limited in its functions to the establishment of certain standards and certain guiding principles which the states follow in drawing up their plans for vocational rehabilitation.

The first and perhaps most important single regulation that the Federal Office has established with respect to the medical aspects of rehabilitation, is the requirement that every client must have a general medical examination as a part of the determination of his eligibility for service under the program. That means not only to establish eligibility for medical service but eligibility for voca-

tional training or vocational guidance, or for placement services. Therefore, any person in the United States or its possessions who has a disability, mental or physical, that is an employment handicap, may apply for service to the state agency, and in the process of determining eligibility, that individual receives a general medical examination.

How far the states will go in examining the eyes of these applicants is hard to say. Frankly, up to now, I am afraid it hasn't always been as far as one might like. In the *Manual of Policies for Physical Restoration*, we have made the statement that the services of a qualified ophthalmologist must be secured for the examination of any individual who has a visual handicap that requires, in the opinion of the examining physician, something other than refraction. We recommend that all visual handicaps be examined by ophthalmologists.

How far the states will carry out these recommendations, we do not know. They have been issued only about a month, and the states are just beginning to establish the physical restoration programs. We are hoping, though, very much, that in all communities where there are ophthalmologists available at hand or nearby, the state agencies will send every applicant who has a visual handicap, for examination by an ophthalmologist.

Of course, where there are distances to be covered, it is probable that the states will have to rely, and will rely, on the general medical man's opinion as to whether this particular visual handicap requires an ophthalmologist's examination or not. We know there will be errors in that. As far as we can see, though, the only practicable thing is to rely on the general medical man because that is the only possibility not requiring two or three hundred miles of travel which might be necessary to reach an ophthalmologist in some states.

In establishing their physical restoration services, the Federa Office requires that each state agency have a medical consultant, who will be part- or full-time, and available for daily consultation. He may be an ophthalmologist or may not be, depending on what the state may choose—and in addition a professional advisory committee on which ophthalmology will be represented.

The national office has established a professional advisory com-

mittee, and the ophthalmologist selected for that committee, partly upon the recommendation of the National Society for the Prevention of Blindness, is Dr. Purman Dorman of Seattle, Washington. Many of you have heard of him. He is very active in aid to the blind, and other services for the blind, in the State of Washington.

In providing services, after the examination, for the handicapped client, the state agency will be guided by the opinion of the examining physician or physicians, including that of any specialists who examined the case.

If the individual has a handicap which is an employment handicap and which is static and remediable, and if the individual is in financial need, then the state agency may furnish him or her with the necessary medical services to correct that disability without cost. Such services may include anything from a single doctor's visit to hospitalization and surgery. Hospitalization, however, is limited to ninety days in any one case, so far as federal reimbursement is concerned.

Once the physical restoration is accomplished, the individual will then in many cases receive vocational training suitable for his particular disability, and eventually be placed in a suitable job. That is the aim of the program; and the philosophy of our office and of the state agencies, is that an individual is not fully rehabilitated until he is placed in employment in a capacity in which he is able as a worker to compete on normal terms with other workers; in other words, though he is a handicapped individual, he is not handicapped for that particular job and should be able to compete satisfactorily with normal individuals. That is true not only for all other types of handicapped persons, but also for the blind, for whom we have a special section. It should be noted, however, that the state rehabilitation agencies place disabled individuals, not only in ordinary industry and agriculture, but also, when necessary, in sheltered workshops and in remunerative work in their homes.

The place of the blind person in industry has been greatly enlarged of recent years. The head of our section for the blind is Mr. Joseph Clunk, himself totally blind, and a great worker for placement of the blind in industry. All these handicapped in-

dividuals will, of course, receive full physical examinations in addition to examination of the eyes, because, after all, if a man has an arm off, and goes to a job suitable for a person with one arm, he may fail at this job because he has bad vision too. That would obviously not be successful rehabilitation.

We know of individuals placed satisfactorily, with one leg off, who six weeks later died of tuberculosis because nobody did an examination of their chests. We now hope to avoid such serious errors.

In passing, I should like to mention the training course for blind placement agents, which began last Monday in Baltimore. This, so far as we know, is the first course of its kind in the world. There are assembled in Baltimore about twelve totally blind individuals from different states who are to spend six weeks there under the auspices of the national office, learning jobs by going into some twenty-one industries in Baltimore and actually learning how to operate different machines and different processes. These individuals, having been trained in these twenty-one industries, in about one-hundred-and-twenty-five different kinds of jobs, and being able to do them themselves, will then return to their state agencies as placement agents for the blind. They will demonstrate to the employers in their own states the capacity of a blind individual to do a given industrial job and, having demonstrated it, the placement agent will then be able to place a blind individual in a job which up to that time an employer did not realize a blind person could do.

It seems to me that we have a tremendous opportunity ahead of us in the rehabilitation program to co-operate with the National Society for the Prevention of Blindness, and the Industrial Hygiene Division of the Public Health Service, in placing visually handicapped individuals according to some better standards of visual requirements of jobs than we have ever had before.

We know that in the past the vocational placement agencies have had to place handicapped individuals more or less by guess, and it will be a tremendous asset to the program which we are very eager to take advantage of, to have the information that Dr. Lo-Presti, the National Society for the Prevention of Blindness, U. S. Public Health Service, and others have been gathering in in-

dustries. We are hoping it will be made available to the rehabilitation agencies for their use in placing visually handicapped individuals in suitable opportunities. In our turn we will be able, we hope, to collect data of interest and use to the National Society and other groups interested in the prevention of blindness and in work with the blind. As time goes on we will learn more about the success of visually handicapped persons in different types of jobs, not only from an industrial standpoint but from a medical standpoint. We will follow up placements of these individuals, so that we can know not only about their success from an industrial standpoint but also the effect on their health, of the jobs they do.

Finally, although this is primarily a civilian program, it is a fine opportunity for preparation of our schools and our industries for the rehabilitation of our veterans. We are now starting with this backlog of three or four million handicapped people in the United States, and through our experience in physical restoration, vocational training, and placement of these individuals, we hope that not only the vocational rehabilitation agencies, but also the industries themselves, will learn, in the next year or so, about the satisfactory employability of handicapped individuals. When our veterans begin to come back in large numbers, we will then have helped to lay the groundwork for the satisfactory rehabilitation and re-employment of our service-disabled veterans.

The Forum

THIS section is reserved for brief or informal papers, discussions, questions and answers, and occasional pertinent quotations from other publications. We offer to publish letters or excerpts of general interest, assuming no responsibility for the opinions expressed therein. Individual questions are turned over to consultants in the particular field. Every communication must contain the writer's name and address, but these are omitted on request.

Children With Visual Limitations

Parents of a visually handicapped child must have numerous questions in regard to rearing him. What kind of person will he become? What kind of life will he have? Will he be a happy person? This message is for those parents whose children are not blind but have a visual handicap serious enough for placement in a sight-saving class.

At the outset, it is of course essential that everything possible be done to overcome whatever difficulty exists, but if it cannot be remedied the child's parents must consider what kind of person he is to become. It is in the earliest years of a child's life that the basic patterns of his life are laid. The kind of person he will become will depend in large measure on how well his parents learn to understand him and to treat him as an individual. He has his own pattern of growth, and the parents' responsibility is to create the most favorable conditions for that growth. Parents sometimes ask why they should spend so much time with the child during the first year of life. Can't a nurse look after his physical needs during infancy just as well as they? One answer to this question is that what the parents learn about the child when he is very young will be of great value throughout his childhood and adolescence because he is likely to display the same dynamic characteristics then as earlier. Then, too, there is the child's need to feel loved and wanted. A limitation such as low vision may very likely make a child feel physically and emotionally insecure. For this reason, it is especially important to make him feel wanted and needed. Emotional security will help make up for his feeling of physical insecurity.

If the parents of the visually handicapped child know about the child's visual limitation early in his life, it gives them time to become accustomed to the idea. This is valuable because it is one thing to know about his limitation, and another to face it and learn how to live with it. This last is very important because the parents' attitude and feeling about it will be quickly felt and understood by the child. It will also be reflected by members of the immediate family, other relatives, and friends. If the attitude is one of over-protection, it may result in his exclusion by the children in the neighborhood from their activities, because they don't want to be bothered with someone who is different or who might require extra attention from them. Something might happen to him!

We should like to tell you about the little boy whose eyes appeared different from those of other children. His mother had him join the local YMCA so that he could take advantage of the swimming pool during hot summer days. The boys who were strangers to him asked him what was the matter with his eyes. At first he hesitated to tell them, but finally, when they persisted, he told them exactly what was wrong with his eyes. Their curiosity was satisfied once they knew the facts, and they now accept him as one of the group. A wholesome attitude on the part of both parents and child, as well as understanding by playmates, is most important, and must be developed early in the child's life if he is to be a happy adult.

As parents better understand the needs of the child's growing personality, the more wisely will they be able to play their part. It is natural that parents of a physically handicapped child should feel powerful impulses to make up to him for his deficiency; but yielding to these impulses may have effects opposite from those which they desire. Their impulse to make good his deficiencies is an impulse to ease a pain. It is hard to accept a deficiency in one we love; but it is the part of wisdom and understanding to accept limited vision in a child and to gain his acceptance of it. A child with limited vision is not aware of much he does not see, and will not be uncomfortably aware unless his parents and others make him so. Parents should be perceptive and sensitive to such a child's behavior at all times, but their sympathy should be guided by an objective awareness of his need for courage and initiative in doing things for himself. By such an attitude, consistently maintained, they may best ease their own pain and help the child to compensate in wholesome ways for his limited vision.

Instead of deriving satisfaction by "doing" for him, parents must discipline themselves to teach him to do it for himself. This takes time and limitless patience, but the child

will derive exhilaration and satisfaction from his accomplishment. It isn't the size of the task which counts, but it is the fact that through "doing" it himself he becomes self-reliant. With the feeling of physical independence will come a sense of responsibility, and ultimately of freedom. A mother tells us that since the war she has lost her maid, and through necessity her ten-year-old daughter, who has low vision, has had to help with the housework. She not only does it well, but enjoys it. She would like to caution parents not to spoil their children who have physical limitations! It is important, then, for the child to acquire early in life a feeling of success, both in work and in play.

Little has been said about general health. We want to stress that there is a direct connection between it and stability of character. General health should be maintained at the highest level, and particular attention should be given to the eyes. If glasses are necessary, they should be kept clean and properly adjusted. Eyestrain should be avoided.

A noted physician tells us that vision is so fundamental in the growth of the mind that the baby takes hold of the physical world with his eyes long before he takes hold of it with his hands. Yet he cannot achieve full acquaintance with things through the eyes alone. He must feel them with his hands. The world of the child with low vision is necessarily more limited than that of the child with normal vision. Parents can help make his life richer through proper attention to his environment. As an infant he should have simple toys around him, such as rattles, small bells, soft balls, soft stuffed dolls; music, too, should play a part in his world. Colored toys will help him recognize and find them. Gradually, the child will learn to amuse himself without the constant attention of his parents. Yet, he must learn to play with other children, and to be accepted by them. Through play activity which is creative, the child develops self-confidence. By participating in the group he learns to be social and derives the benefits of getting along with others. Nursery school should be an excellent experience for the child with low vision, because it gives special training under supervision. This is valuable, for there is a tendency for these children to be less active, less aggressive, and to have less initiative. Parents of a child with low vision need not be surprised if he is somewhat retarded in his speech habits, since his ability to imitate decreases in proportion with the decrease in vision. Of course, steps should be taken to correct any speech defects as soon as possible, for obvious reasons. Association with other children would be of value in this respect.

May we sum up by reminding parents to try to see the child in

terms of what he is, and what he has. Mrs. Hathaway, Associate Director of the National Society for the Prevention of Blindness, says: "The first step in all modern education is to find wherein strength lies and to build upon that as a foundation." Don't live only for the child, live with him. Have other interests and activities so that his life will be richer through living with someone who has an actively interested mind. The child cannot help having bumps, as all children must, and parents cannot prevent them, but they can help him be strong enough and flexible enough to take them as they come with poise and equanimity.

—MARGARET RARIG OSTERMAN
Washington, D. C.

Note and Comment

National Society Honors Its President.—In recognition of his devoted service as head of the organized movement for protection of eyesight and the conservation of vision, Mason H. Bigelow, President of the National Society for the Prevention of Blindness, was presented with an illuminated scroll by the Board of Directors of the Society on the occasion of its 30th Annual Meeting in New York City.

"Too often we take for granted this kind of service and leadership and miss the opportunity of voicing our sentiments when they are so richly deserved," commented Dr. John L. Rice, former Health Commissioner of New York City, and member of the Society's Board, in making the presentation.

"There are many modest men, giving freely splendid service to their fellow men, who fail to receive the recognition which is their due. The National Society for the Prevention of Blindness has one of these outstanding, splendid modest men as its President, and today it is my happy privilege to present to him in the name of the Board of Directors their thanks in the form of an inscribed document which reads as follows:

" 'The Directors of the National Society for the Prevention of Blindness, Inc., take occasion to record their high appreciation of the competent, devoted service that is being rendered by President Mason H. Bigelow to the Society and to the cause of eyesight conservation. At sacrifice of time and convenience, he is contributing leadership of an effectiveness that is gratifying and inspiring to the Directors. This leadership exemplifies and personifies the spirit of philanthropy which so largely characterizes the object and work of this Society.' "

Ophthalmic Gold Medal.—From the *Journal* of the A.M.A., we learn that The Ophthalmological Society of Egypt will award a gold medal annually for the contribution deemed most valuable that year in the field of ophthalmology. A competitive essay will determine the award, which will be considered at the annual

congress of the Society. Additional information may be obtained from the Ophthalmological Society of Egypt, Dar el Hekma, 42 Kasr el Ainy Street, Cairo.

Dr. Alan C. Woods, Baltimore, was named president-elect of the American Academy of Ophthalmology and Otolaryngology at its annual meeting in Chicago, October 12, and Dr. Gordon B. New, Rochester, Minn., was inducted into the presidency. New vice presidents include Drs. Edmund B. Spaeth, Philadelphia, William H. Johnston, Santa Barbara, Calif., and Lieut. Col. Brittain F. Payne, M.C. The next annual meeting is scheduled at the Palmer House, Chicago, October 7–11, 1945.

Collection of Historic Tonometers.—The tonometer checking station at the Illinois Eye and Ear Infirmary is making a collection of historic tonometers. Will any reader who has a tonometer of interest for this collection donate it for display? Credit will be shown. Any descriptive letters of such tonometer will be appreciated. Address Dr. Harry S. Gradle, 58 East Washington Street, Chicago.

Institutes Co-operative Project with War Production Board.—In a letter to American industrial managers, Donald M. Nelson, then Chairman of the War Production Board, asked their co-operation in a drive to improve production through the conservation and utilization of eyesight in industry.

"This is a matter of great practical importance to the war effort, as well as to postwar production," Mr. Nelson said.

Mr. Nelson said that the U. S. Public Health Service, Department of Labor, War Manpower Commission, and WPB, with the co-operation of the National Society for the Prevention of Blindness, are offering assistance to industrial plants for the improvement of "visual-production" conditions.

He said that studies made in many industries show that management can realize production gains of as high as 25 per cent by constructively attacking this problem through the use of corrective glasses, proper lighting, protective eye equipment and job reassignment.

The WPB chairman explained that disturbing key facts brought

to light by investigations of the National Society for the Prevention of Blindness were:

Subnormal eyesight keeps 25 per cent to 40 per cent of war workers below normal production.

Inadequate illumination and glare in many factories handicap the entire working force.

Absenteeism, fatigue and accident rates are substantially increased by eye strain.

Protective goggles and other equipment are often not supplied in sufficient numbers, not properly fitted, and not adequately maintained and used.

Mr. Nelson said that the service to industrial plants for the improvement of visual conditions now adversely affecting production is offered without charge by the combined government agencies co-operating with the National Society for the Prevention of Blindness.

Mr. Nelson's letter closes with the comment: "When a job needs vision, a man cannot work better than he can see."

In the carrying on of the co-operation with these governmental agencies, Mr. Charles P. Tolman, the Society's consulting engineer, will act as liaison officer. As of November 15, Miss Florence Nelson, formerly editor of *Safety Education*, has been engaged by WPB to assist in the carrying on of this program in the Society's offices.

Inter-American Health Service in Paraguay.—A report has been published covering the first two years of the Inter-American Cooperative Health Service in Paraguay. Appearing in the *Newsletter* of the Health and Sanitation Division of the Office of the Coordinator of Inter-American Affairs, the report covers the two-year period from 1942 to 1944. One of the first undertakings of the co-operative health service in Paraguay was the construction of a large building in Asunción to provide office space for the ministry of health, the director of the department of public welfare and the director of the department of hygiene, as well as space for a number of the divisions of the department of hygiene and the principal health center for Asunción. Among the clinics provided in the health center section is one for eye, ear, nose and throat.

Orthoptic Clinic Established in Indianapolis.—An orthoptic clinic has been created at the James Whitcomb Riley Hospital for Children, Indianapolis, to provide special training for children having difficulty in eye focusing and to supplement surgery for correction of crossed eyes. The new unit will add to the Indiana University Medical Center's facilities, of which the Riley Hospital is a part.

New Periodical on Reconditioning.—A new publication, *Reconditioning News Letter*, is now being distributed monthly by the Office of the Surgeon General to all Army Service Force hospital commanders and service command surgeons. Its aim is to familiarize hospital personnel with new ideas, practices and procedures connected with the reconditioning program. Sources of the items published are reports made by inspecting officers from the Surgeon General's Office, chiefs of the reconditioning branches in service commands, medical officers and others familiar with the program.

Dr. Raphael Silva.—Mexico lost one of her leading ophthalmologists, Dr. Ralphael Silva, April 16, 1944. Having studied in Europe under Professors Fuchs and Axenfeld, he opened practice in the office of Dr. Fernando Lopez. From this beginning he became ultimately director of the Ophthalmic Hospital of Nuestra Señora de la Luz. Among other appointments, Dr. Silva has held those of professor of ophthalmology at the Escuela de Altos Estudios; director of the Health Department of Mexico; member of the committee awarding the Kellogg Foundation-Pan-American Congress of Ophthalmology fellowships.

Institute on Nursing Care of Eyes in Industry.—At the request of a group of industrial nursing consultants and supervisors, and in conjunction with the annual meeting of the American Public Health Association, a conference on eye health in industry was conducted in New York City, early in October. This was a milestone in the Society's industrial nursing program, being the first institute-type of conference on nursing care of eyes in industry. Forty-seven consultants, supervisors, and instructors, from 16 states and two Canadian provinces attended the three sessions.

Speakers included Dr. Joseph Lo-Presti, Assistant Surgeon (R), U. S. Public Health Service, assigned to the Society, Mr. Frank J. Connell, safety engineer of the Sperry Gyroscope Company, and Miss Eleanor W. Mumford, R.N., the Society's associate for nursing activities.

Society's Glaucoma Exhibit Gets Award.—At the last meeting of the American Academy of Ophthalmology and Otolaryngology, the "First Award for Excellence in Presentation in Ophthalmology" was given to the glaucoma exhibit organized by Dr. Mark J. Schoenberg, chairman of the Committee on Glaucoma of the National Society for the Prevention of Blindness, with the co-operation of the Committee and other ophthalmologists. Miss Virginia M. Smith, staff associate, who assisted in the preparation of the exhibit, was available for consultation at the booth during the Academy Meeting, which took place in Chicago, October 8–12.

Upon invitation, Mrs. Eleanor Brown Merrill, executive director, and Miss Isobel Janowich, editor, presented the exhibit on progress in sight conservation, at the Academy Meeting. The exhibit, which emphasized mainly industrial ophthalmology, also included a small section on glaucoma, in which the Minnesota Society for Prevention of Blindness co-operated. Dr. Joseph Lo-Presti presented a paper on "The Connecticut Experience with Eye Problems in Small Industries," at the meeting sponsored by the Joint Committee on Industrial Ophthalmology. Dr. Lo-Presti, Mr. Tolman, and co-operating ophthalmologists, were available for consultation, especially in the field of industrial problems.

Society of Kellogg Fellows.—The organization of the Society of Kellogg Fellows was recently announced. Named in honor of the founder of the Kellogg Foundation, the society aims to stimulate professional and educational activities of Latin-American ophthalmologists. Dr. Harry S. Gradle, Chicago, was chosen honorary president. Members of the Society are all Latin-American ophthalmologists who have carried on postgraduate studies in their speciality through the aid of the W. K. Kellogg Foundation and the Pan-American Congress of Ophthalmology. Members of the organizing committee are Drs. Daniel Silva, Mexico; Agustin Perret, Venezuela; and Manoel A. da Silva, Brazil. The final

steps to complete the organization were taken during the annual meeting of the A.A.O.O. in Chicago, October 8–12. *Ophthalmologia Ibero-Americana* has been designated the official journal of the Society.

Medical Social Consultant in Vocational Rehabilitation.—Marian E. Russell, executive secretary of the American Association of Medical Social Workers, has been appointed medical social consultant in the office of vocational rehabilitation, Federal Security Agency. Miss Russell will aid in the formulation and development of medical social aspects of the vocational rehabilitation program, especially as they relate to physical restoration of disabled persons. She will provide consultant and technical services for the federal office and for the state divisions of vocational rehabilitation and the state agencies for the blind.

Fifth Anniversary of Sociedad de Oftalmologia del Litoral.—The *Sociedad de Oftalmologia del Litoral*, Argentina celebrated the fifth anniversary of its founding, during its regular scientific session. Dr. Carlos Weskamp, President, summarized the accomplishments of the Society during the last year.

A National Health Service in Britain.—The British government has announced its intention to establish a National Health Service for all Britons, and has invited frank criticism of the proposal. Like the Wagner-Murray-Dingell Bill in this country, it has engendered considerable controversy. Under the existing National Health Insurance, British ophthalmologists operate as consultants. Ophthalmologists feel that refracting opticians should be co-ordinated, though subordinately, with ophthalmologists. Opticians, on the other hand, as in this country, argue that refraction is the peculiar domain of the optician and that medical training does not prepare others to perform it; that ophthalmologists and opticians should regard themselves as complementary to each other.

Eye Examination in School Children.—Dr. Lawrence T. Post, in an editorial of the *American Journal of Ophthalmology* (September, 1944) reflects that one of the most important contributions to eye welfare has been the establishment of ocular examinations in

schools. The nature of the tests is of course important. Of factors pertaining to sight: external diseases, central visual acuity, muscle balance and power, fields of vision, fundoscopy, color discrimination, fusion and refraction—at least the first two, and perhaps the third, should be tested in schools. With respect to visual acuity, Dr. Post advises that in addition to the 20-foot test, tests at reading distance should be given. Complete tests should be made in the schools and in the offices of ophthalmologists to whom children with reading difficulties are referred, and the direction of remedial reading by a trained psychiatrist will succeed in certain cases.

New Glaucoma Prize.—A prize of $500 for the most valuable original paper adding to existing knowledge about the diagnosis of early glaucoma or the medical treatment of non-congestive glaucoma is being offered by the National Society for the Prevention of Blindness. This award will take the place of two separate prizes of $250 each which had been announced some time ago.

Papers may be presented by any practicing ophthalmologist of the Western Hemisphere and may be written in English, French, German, Italian, Spanish or Portuguese. Those written in any of the last four languages should be accompanied by a summary in English.

The award will be made by the Society with the guidance of an ophthalmological committee composed of Doctors John N. Evans, Frank C. Keil, Daniel B. Kirby, Arnold Knapp, John M. McLean, R. Townley Paton, Algernon B. Reese, Bernard Samuels, Kaufman Schlivek, Mark J. Schoenberg, Manuel Uribe Troncoso, David H. Webster.

Latin-American Developments.—The Mexican Association for Prevention of Blindness celebrated its twenty-fifth anniversary in August with an eight-day conference in Mexico City. Delegates from various countries participated, and the Society extended greetings through a representative who was in Mexico at the time. It will be recalled that Dr. Luis Sanchez Bulnes, a guiding spirit of the Association, represented his country at the Society's Annual Meeting last year.

Two medical social workers from São Paulo, Brazil, Miss Maria

Conceicao de Carvalho and Miss Andreina Campanella, are attending the course in medical social eye work sponsored by the Society at Washington University, St. Louis, during the present semester. Training for these workers, who will return to Brazil to undertake responsibilities requiring this special preparation, was made possible through assistance from the Office of the Co-ordinator of Inter-American Affairs.

Physicians Warned to Exercise Care in use of "Doryl" for the Eyes.—A warning to physicians to exercise care in the use of "Doryl," a crystalline preparation intended only for use in the treatment of eye diseases, is made by *The Journal of the American Medical Association* in its December 18 issue. Deaths have recently been reported following injection of the preparation, *The Journal* says, explaining that the drug "is available as a solution in ampules for intramuscular injection and as crystals for use in preparing solutions for the eye. Because the crystals also have been marketed in ampules, errors have been made in preparing these crystals for injection rather than using the available ampule solution for intramuscular use. The deaths which followed injection were due to the fact that the concentration was several hundred times greater than it should have been. . . ." Despite changes in labeling and packaging, at least two deaths have since occurred. The firm has now asked for the return of all Doryl shipped prior to October 1, 1943. "Physicians," *The Journal* warns, "should examine carefully their own supplies to prevent further accident."

Henry Randolph Latimer.—Readers of the REVIEW will be grieved to hear of the death of Mr. Henry Randolph Latimer, for many years the executive director of the Pennsylvania Association for the Blind. Mr. Latimer was not only a leader in the field of the care of the blind, but in the field of prevention of blindness.

Book Reviews

YOUR EYES. Sidney A. Fox, M.D. New York: Alfred A. Knopf, 1944. 191 p.

The author has undertaken the difficult rôle of teaching his readers what they should know about their eyes. As he rightly states in his preface, what the average man knows is often misinformation gleaned from sources more interested in selling a product than in disseminating accurate facts.

The chapters cover a wide variety of subjects which include eyeglasses, color vision, tinted glasses, the eye muscles, illumination, the eye in traffic, eye physicians and optometrists, quacks and panaceas, hygiene and first aid, the young, adult and old eye. The index is complete and informative.

Ordinarily a layman would not be expected to comprehend so much material in the realm of science. Major Fox, who was a practising ophthalmologist in New York City, is gifted with an entertaining literary style that lifts up the reader's interest just as a topic begins to "get dry." One wonders whether the average person is sufficiently interested in blepharitis, vernal catarrh, trachoma and the technicalities of color vision to have them treated in a popular treatise. Far outweighing this criticism is the theme throughout that "ailing eyes should receive prompt and competent attention."

Dr. Fox's approach is similar to the educational campaign of the National Society for the Prevention of Blindness and he has reprinted in full their 12 rules for the glaucoma patient. He rightly pleads for the routine eye examination of all children at the ages of 3, 7 and 12, when most can be accomplished in the field of prevention.

The functions of the eye physician and optometrist are intelligently presented and quackery, particularly as exemplified by the "sight without glasses" faddists, is completely exposed. Vitamins are also subdued and put in their proper place.

Every eye physician is familiar with the many questions asked daily by patients, that are so well answered by the author. The food

for thought in this book is not new but it has been made more palatable and is easier to digest. *Your Eyes* deserves a wide circulation among the laity, social workers, and general practitioners of medicine.

—James W. Smith, M.D.

Industrial Ophthalmology. Hedwig S. Kuhn, M.D. St. Louis: The C. V. Mosby Co., 1944. 285 p.

Dr. Kuhn has written a comprehensive and concise treatise relating to the various problems in industry which bear a special relationship to ophthalmology.

The research and investigative work upon which this volume is based was undertaken by a Joint Committee on Industrial Ophthalmology representing the Section on Ophthalmology of the American Medical Association and the American Academy of Ophthalmology and Otolaryngology. To this work, the author has made many contributions. Her experience in the many phases of the problems of vision in industry, has been an extensive one.

The book presents, in a very systematic manner, a broad eye program for industry. It includes, in its six chapters, a consideration of vision testing in industry; correction of visual defects for the job; and the important relationship to industry of "visual skills." The chapter on "Eye Protection" is devoted primarily to a discussion of the various factors which enter into a proper goggles program.

A chapter is devoted to recent developments as related to industrial eye problems. Included are a consideration of the all-important matter of proper illumination, medico-legal angles in the handling of eye cases, problems of radiation, welding and "flashes," and problems of visual rehabilitation.

Dr. Albert C. Snell has contributed an authoritative chapter on the medical and surgical treatment of eye injuries.

The appendix contains suggestions for the basic treatment of toxic hazards, a glossary of toxic substances and their effect, an all-inclusive outline of an eye program for industry, and a section relating to the "appraisal of loss of visual efficiency"—a standard method approved by the Section on Ophthalmology of the American Medical Association.

The subject matter of this book is covered in 285 pages. There are 114 text illustrations, including 2 color plates. The book is interestingly written, it is authoritative, and practical. It should be "first reading" for all who are interested in ophthalmology in industry.

—GEORGE FREIMAN, M.D.

BLOOD TRANSFUSION IN OPHTHALMOLOGY. Eye Clinic of the Tashkent Medical Institute. Tashkent, U.S.S.R.: State Publishers, 1941. 56 p.

This book contains nine articles by ophthalmologists of the Eye Clinic of the Tashkent Medical Institute on the value of blood transfusions in ophthalmology. Prof. P. F. Arkhangelsky and his associates have been using blood transfusions since 1935. They used mostly conserved blood (from one to sixteen days), in small quantities (from 75 c.c. to 250 c.c.), with an interval of about 10 days and regarded the action of the blood as non-specific, possibly accelerating the metabolism of the tissues and activating the reticule-endothelial system.

Blood transfusions were applied in various eye diseases, but the most striking results were obtained in vitreous opacities regardless of the etiology; next were hemorrhages in the retina, soft lens matter in the anterior chamber after extra-capsular extraction. Favorable results were also observed in trachomatous pannus and herpetic keratitis by using subconjunctival injections of blood (from 0.5 c.c. to 1.5 c.c.). One of the writers (Meschersky) reported that two patients with chronic glaucoma responded well to blood transfusions as the tension was lowered, the visual acuity and visual fields were increased. A few cases of blepharitis, which did not respond to any type of therapy, improved considerably under blood transfusion therapy. Some cases of corneal transplants which became opaque cleared up after the blood transfusions. These latter, however, are not considered to be a panacea for all ills, and the writers state that blood transfusion should be applied only when all other measures fail. It could also be applied as a prophylactic measure before intra-ocular operations. A plea is made for further study of the therapeutic action of the blood in pathological conditions of the eye.

—OLGA SITCHEVSKA, M.D.

Briefer Comment

A Manual for Parents of Pre-School Blind Children. Edith L. Speer, Director, The Lighthouse Nursery School. New York: New York Association for the Blind, 1944. 20 p.

Miss Speer elucidates the aspects of development of the blind child which differ from those of the sighted—the "blindisms" into which he so easily falls—but emphasizes that in every respect the child should receive training as nearly as possible approximating that of the normal, to prepare him for living independently among the seeing.

The pamphlet illumines methods and procedures of training from birth to school, and will interest not only parents, but teachers and others as well.

Manual of Industrial Hygiene and Medical Service in War Industries. William S. Gafafer, D.Sc., Ed., prepared by the Division of Industrial Hygiene, National Institute of Health, U.S.P.H.S. Philadelphia: W. B. Saunders, 1943. 466 p.

This handbook was prepared as a source-book for experienced industrial physicians meeting new conditions in war-converted industries, and for those physicians new in the field, who are taking the places of those in service. It consists of three parts: "Organization and Operation of Facilities"; "Prevention and Control of Disease in Industry"; and "The Manpower Problem." Those concerned with industrial vision will find chapters 2, 4, 16, 20 and 22 of particular interest.

The Principles and Practice of Industrial Medicine. Fred J. Wampler, M.D., Ed. Baltimore: The Williams and Wilkins Co., 1943. 555 p.

Like the U.S.P.H.S. *Manual* discussed above, this volume is intended as a guide for the physician entering the industrial field; but it is designed also as a textbook for developing the curriculum in industrial medicine. Dealing relatively briefly with methodology and organization of plant medical and safety departments (as compared with the *Manual*), it covers extensively the questions of environmental factors (temperature and humidity, illumination, toxic substances, electricity). Other chapters cover disease factors, accident factors (including predisposing elements and compensation), rehabilitation, and the position of women in industry. Those concerned with welfare of vision in industry will be especially interested in chapters III, X, XXVI, XXIX, XXXI.

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Eye Exercises—Do They Do Any Good? Do They Do Any Harm? Their Limitations

Walter B. Lancaster, M.D.

THE author presents the "debit" and the "credit" sides of eye exercises.

IT IS not necessary to be a doctor to realize that exercises, practice, repetition, doing a thing over and over under competent supervision, are the universal means by which one learns, and are not limited to a few branches of learning. The child learns to write, to draw, to play a musical instrument, to play games, to wrestle, to fight, to sing. The surgeon makes use of exercises to cure defects and deformities: flat feet, crooked backs, weak muscles.

Dual Function of Exercises

Exercises are used to develop skill and to increase muscular strength, sometimes both. But they are not limited to things requiring muscular activity—motor functions. The same principle applies to sensory functions. The young violinist has to learn to use the fingers of his left hand on the strings and to use his right hand and arm to manage the bow, but it is indispensable that he learn to tune the instrument and that he learn so to place his finger tips as to produce the correct pitch and that is a matter of training the ear, that is, hearing, and of co-ordinating fingers and ears. The tea taster has to learn by practice, has to train and develop his sense of taste and smell.

The student of art in learning to appreciate painting, has to train his eye, has to develop his ability to see. This is done by practice under competent teachers. The sailor has to learn to

recognize different vessels and different airplanes. The hunter has to learn to see things in the woods.

One of the most fundamental laws of biology is that repetition of an act facilitates its performance. The first time one does something it may be done clumsily and laboriously, the hundredth or the thousandth time it may be done dexterously, and with ease.

If the act involves muscular action, as most acts do, one result of practice, repetition, exercise, is that the muscles involved increase in size and power (hypertrophy)—become stronger. For example, in learning to row, two things are involved, skill in handling the oars, and strong enough muscles to do the work required. If the muscles are already strong enough, no increase in strength results from the exercise—only increase in skill. In exercises at the piano, it is not stronger muscles that are the aim, but skill in using the muscles.

Thus, one can think of the muscles and the nerves and the nerve centers in the brain and spinal cord as constituting a *neuro-muscular mechanism*. Sometimes the main thing is developing stronger muscles for a particular act but far more frequently it is the *neuro* part of the neuro-muscular mechanism that requires developing. We shall see how important that is in developing vision—ability to see, to use the eyes.

Seeing—Half Ocular, Half Mental

Seeing can be analyzed into several parts. First, an image of the object looked at is formed on the retina. Second, the eyes must be moved so that the images on the two retinas fall on the most sensitive parts of the two retinas so that one can see the object most distinctly (*fixation*, often erroneously called focusing) and so that the image of one eye blends or fuses with that of the other eye (*binocular vision*). Third, the image must be focused so that it is sharp and well-defined, not blurry; this is done by the accommodation. The result is a sensation—two sensations in fact, one for each eye. This is the first step in seeing. But it is only the first step. Its importance is greatly overstressed. The reason its importance is overemphasized is that defects in this part of the act of seeing can be helped by glasses. As a matter of fact, eye specialists devote most of their time to correcting certain common defects

of this kind (myopia, hypermetropia, astigmatism, presbyopia, heterophoria). Hence it is not to be wondered at that they emphasize the importance of this part of the visual function—the ocular or physical part.

The Brain in Seeing

The second and equally important step in seeing is this: the sensations must reach consciousness and become perceptions. It has been thoroughly established that it is impossible to experience a pure, isolated sensation. There are two factors which affect all sensations as they reach consciousness and become perceptions. In the first group are all those other sensations coming into consciousness at the same time not only through the visual apparatus but also through auditory, tactile, kinesthetic and all other avenues. The second group comprises memories of past experiences and even inherited predispositions. A mere glimpse, perhaps in a dim light, of an object well-known from previous experience results in "seeing" many details which as a matter of fact are supplied by memory, though quite unconsciously and automatically. A familiar figure is dimly seen at twilight walking with a child and a dog across the street. The woman is heard to call the dog and the familiar voice confirms the inadequate sight and details are supplied by memory; details which include the hat and dress of the woman and of the child, the color and coat of the dog, etc.

Consider the use of the eyes in reading. When a beginner reads, words have to be looked at letter by letter until they have become familiar as whole units (some methods of teaching require the pupil to learn words as units and not spell them out letter by letter even at the beginning). A new language finds even the expert reader adopting the beginner's method of spelling out the unfamiliar words. Eventually, the expert reader does not even "see" or look at single words, let alone the individual letters of each word, but he scans the lines of words with several fixation pauses of 0.2 to 0.3 seconds duration, and with very rapid movement (0.02 to 0.03 seconds) from one fixation to the next. Because he comprehends what he is reading he needs to catch only a word here and there and *his mind supplies the rest.* And yet the expert proofreader will detect a misspelled word or error of punctuation or other defect

because something about the word or words does not fit the mental picture (the memory picture) with which it is incessantly being compared.

Thus, learning to read involves among other things (such as acquiring a vocabulary of the language being read) chiefly storing up memories, mental pictures of words and phrases which a mere glance at the printed line suffices to recall. One may silently or even audibly form the words with his lips to aid the visual impression by the vocal and auditory memories of the same words.

Notice that from the factor of experience (memory) arises the ability to complete a pattern from incomplete data. Then there is the "rectifying capacity" by which an image of a ring held tilted at an angle so that it forms an elliptical image on the retina is perceived as a circle, not an ellipse; or a square card tilted so that its image on the retina is not square is nevertheless perceived as a square.

Determining Results of Eye Exercises

Before taking up specific examples of the effect of eye exercises, there is one important question to be answered. How is one to determine the results? There are two ways. The commonest and most important measure of visual performance (of seeing) is the Snellen test. This consists of a chart with letters or other characters of different sizes arranged in rows. Each row is marked with a number which is the distance at which the letters in that row can be read by a person with standard normal vision. If feet are used, the lines are, for example, 10, 12, 15, 20, 30, 40, 60, 100; or if the metric system is used, the lines are 3 meters, 4 ,5, 6, 8, 10, 12, 15, 20, and so on. The usual distance for testing is 6 meters. If the subject at 6 meters can read the line marked 5, his vision is 6/5, if he can read no more than the line marked 12, his vision = 6/12, etc. When proper precautions are observed, this gives a fairly dependable measure of the ability to distinguish small objects called "visual acuity" (abbreviated as V.). It is not the sole method of measuring visual functions. There are other things to be considered besides visual acuity, such as color sense, binocular vision (often referred to as muscle testing) stereoscopic depth perception and

others. It is not necessary to take these up in detail. *All these tests aim to measure in scientific standard units.*

There is another way to estimate the results and that is to ask the patient whether he sees better, uses his eyes more easily and with less discomfort, etc.

The two methods do not always agree. For example, some years ago a young ophthalmologist was sent to Europe to investigate the methods used by quacks and others in treating cataracts without operating. He returned to New York and proceeded to try out these methods on a hundred patients at the Clinic. After a year of careful following out of the treatment, the patients were asked if they had improved and nearly all said they had and wished to continue. But the ability to see had been carefully recorded at the beginning of the treatment, from time to time during the treatment, and at the end. The sad facts were that the vision was rather worse than at the beginning. The cataracts had continued to progress in spite of the treatment. The impression of the patient was a quite misleading guide to the actual result.

It will be enlightening to apply these methods to a few cases where eye exercises or eye-sight training have been used. In that way one can evaluate claims made by advocates of various methods of training or treatment by exercises.

Speed of Reading Improved by Exercises

The speed with which a number of digits or letters are seen can be greatly improved by training and can be measured accurately. Renshaw reported work on the Polish lightning calculator, Dr. Finkelstein, who memorized: 8 digits in .003 seconds; 12 digits in .824 seconds; 16 digits in 1.73 seconds.

Renshaw then trained a dozen university students, two of whom were able, after practice, to surpass Finkelstein's record for speed in learning digit groups. He remarks: "The difference between the expert and the novice in the rapid and accurate perception of visual material is the same difference between the expert and the novice in the performance of any skillful act. We have to learn to see just as we have to learn to swim, to play the piano, or to speak French. This can be done with skill and efficiency or it can be done haltingly and ineffectively. When we train children to learn to

spell English words by replacing the wasteful and ineffective disjunctive method of seeing words with the proper method of visual perception, spelling difficulties disappear. Not only does a child spell accurately and easily, but he comes to enjoy spelling. An incidental by-product also is that his rate of reading and index of comprehension automatically show a corresponding improvement."

Color Blindness Erroneously Thought Improved

Treatment for color blindness in men rejected from military service has been advocated. Color blindness *can* be measured by accurate laboratory tests. It is *usually* measured in the military services by a test which is sufficiently accurate for most purposes but which can be circumvented by practice. In other words, a candidate though still color blind (it is a congenital incurable condition) can learn to pass the test. This test consists of a number of plates called pseudo-isochromatic, designed by Ishihara. The plates consist of a large number of small colored discs of many tints closely packed and apparently irregularly distributed over the page all mixed up. To a normally sighted person, the distribution is not haphazard but there is a large numeral easily distinguished because the tiny discs of which it is made differ in tint from the surrounding spots of color. To a color blind person, the figure is not visible because the spots of color of which it is made do not appear to his eyes sufficiently different from those surrounding it to make a contrast. The American Optical Company has published a set of plates, 46 in number, all different and cunningly disguised to catch and differentiate different types of color blindness. Even "normal sighted" people usually make a few mistakes with this test.

The usual treatment for color blindness in men rejected from military or other service is called the light and filter treatment. As described by optometrists it consists in the fixation of colored sources of light for several minutes, and the use of filters, with daily check of progress on the pseudo-isochromatic plates—the "Light and Filter" treatment.

Two instructors in optometry at Ohio State University, Charles S. Bridgman, Opt.D., Ph.D., and Henry W. Hofstiter, Opt.D., Ph.D., skeptical about this method of improving color vision,

tested several subjects, three of whom had passed the Navy tests successfully after treatments by a practicing optometrist. They concluded that their results did not in any way support the assumption that the *exercises* intended to train color vision are of any assistance. It appeared on the contrary that the exercises are merely time-consuming, that the improvement in scoring is related only to the *learning made possible by repeated testing.* The following is a sample of the results obtained. A color blind subject from the eye clinic, tested in the usual way, scored 15 correct out of 46 plates. He was tested four times. He was told when he was wrong but was not told the correct answer nor given any other instruction—simply retested again and again. His scores were 27, 35, 43 on the second, third and fourth tests. Similar results were shown by other subjects.

The authors further concluded that "those who criticize the practice of training color vision are entirely justified." They "find no evidence that color filter treatment is effective in improving color blindness." They "question the type of evidence which has been accepted as conclusive indication of color vision improvement"; "this proof can be supplied only by measurement of fundamental color vision functions." (Rayleigh equation, etc.) The treatment, they said, is not justifiable since it may lead to the acceptance of responsibilities which the patient cannot fulfill, though he erroneously believes himself cured of color blindness.

Eye Exercises for Myopia

An important group of patients with myopia and other defects earnestly desire to get rid of their glasses. These patients have been told by ophthalmologists or optometrists that they must wear glasses all the time. They go to a follower of Bates who tells them to discard their glasses, which are crutches. To their surprise they find that nothing serious happens! Their sight, of course, is still blurred for distant objects but they find that by practice they acquire the ability to make out objects better through the blur than when they only temporarily took off their glasses during the glasses-wearing period. They are likely to exaggerate this gain in talking about it.

A young man who had been wearing concave lenses asked the writer if there were any way he could pass the test for 20/20 vision. His visual acuity was 20/30 without glasses, 20/15 with his glasses which were concave. To induce relaxation of accommodation, he was given convex lenses. After a few days his vision without glasses was 20/15 and he read 20/15 even with +0.50 sphere. Thus, he was able easily to pass the test for 20/20 vision without glasses. Was his myopia cured? No, because he did not have true myopia to begin with. He had acquired the habit (never mind how) of exerting a small amount of accommodation by which he was able with concave lenses to see extra well. This had become so confirmed a habit that, when the concave lenses were taken off for a few minutes to test him without them, he still exerted unconsciously and automatically this (now unnecessary) accommodation and could see only 20/30 unless the concave (myopic) lenses were given him. This is called pseudo-myopia. Thus what the writer's treatment had done was to teach him to relax his accommodation. He was judged myopic by someone who found that when −0.50 sphere was placed before his eye he said, "That is better, clearer." If a young man who sees 20/15 sees it better with −0.50 sphere it shows that he has good accommodation, not that he has myopia. Other evidence is necessary before that diagnosis is justified. He should read one or two *more* lines with the minus glass than he reads without.

Cases of true myopia have been reported in which the vision without glasses has been improved by exercises of various sorts, from 20/70 or even less to 20/20. The writer has not had personal experience of such cases.

Orthoptic Exercises

A well recognized field for treatment by eye exercises is the field of disturbances of motility and binocular vision. These are often spoken of as "muscle" troubles. It is true that the movements of the eyes are made by the muscles but it is not true that faults of motility are due to defects of the muscles themselves, except in rare instances. As pointed out above, one is dealing with a *neuro-muscular mechanism for eye movements* and it is the *neuro* part that is usually at fault. In many forms of trouble with eye movements

(heterophoria, cross eyes, etc.), much can be accomplished by eye exercises skillfully used by orthoptists.*

A very good example of how exercise, practice, learning, result in ability to see and take in what would be absolutely bewildering to a novice is furnished by an orchestral score. On each page are the notes for all the different instruments of the orchestra being played simultaneously. When a conductor has learned to read such a score, it is not because his vision has improved, but because he has learned how to use it by practice, by exercise.

Many methods of treatment by eye exercises, dispensing with glasses, have been advocated. To describe or even enumerate all is not possible here. The methods advocated by Huxley, Bates, Peppard and others consist in relaxation (passive and dynamic), palming, winking, breathing, sunning; also a group of procedures aimed at increasing mobility, swinging (short and long), flashing, shifting, nose writing.

Extravagant Claims Unjustified

Since exercises of various sorts have been proven so successful in treating many eye conditions, it was inevitable that some devotees of that kind of treatment should go too far and make exaggerated claims. That always happens. It is the duty of the broad-minded, open-minded, well-informed investigator to sift out the good from the bad.

If the results of the various treatments by regular and by irregular practitioners are subjected to the two methods of evaluation mentioned earlier in this article, it is found that in many cases the results measured by scientific methods are sound and good. Other cases show no measurable gain in scientific units such as visual acuity, color vision, motility (cross eyes, etc.), but do show gain when the opinion of the patient himself is asked.

For example, Aldous Huxley has poor vision due to cloudiness of the cornea from old inflammation. Experience with many such cases has demonstrated that this is a condition which has a tendency to show but slight improvement, never resulting in complete cure. Huxley consulted many ophthalmologists with unsatisfactory

* The name for this department is orthoptics, and those who practice it are orthoptists. Some of them have achieved brilliant success.

results. They admitted they could do nothing. After treatment by one of the followers of Bates, Huxley was able to report marked improvement. Judged by the scientific measurement of visual acuity, the Snellen charts, Huxley reads very little more than he did before treatment. Judged by the standard of the patient's own impressions, he *can see better;* at least he can and does use his eyes with much more comfort and does more work with them and is more reconciled to his lot. No impartial judge can deny that this is a worthwhile gain.

It should be distinctly understood, however, that it is not an improvement in the eyes, the ocular part of vision, but in the cerebral, mental part of vision. There has been a tendency to neglect this side of seeing, but as shown in the earlier part of this article, it is a very large and important part, fully 50 per cent. Most of the gains from exercises of various sorts are gains in the sphere of mental or cerebral functioning. This is to be expected, from the nature of the case. Practice alone will not avail much to improve the optical image on the retina, which depends on physical conditions for the most part. But practice, training, exercise will improve the use made of the retinal images by the mind. It is one of the important medical resources.

When untrained and therefore more or less ignorant people attempt to use such resources of treatment it is inevitable that they exaggerate their results, that they fail to put things in proper perspective, and that they embroider their treatment with irrelevant details of no value except as means of impressing the uninformed and aiding in getting the more significant things done. As a result, more or less hocus pocus creeps in. This alienates those who see through these gestures. They are too apt to jettison the whole cargo, the good with the bad.

Are Exercises Harmful?

The harm that can come from eye exercises is due to the curious weakness of the human intellect which sees the good in something and jumps to the conclusion that that is the whole story. Just as the followers of Mrs. Eddy, seizing upon the valuable truth that many sicknesses are more mental than physical and can best be cured by treating the mind, jump to the conclusion that all diseases

are of that nature and so do great harm to patients with definite physical ailments which can be cured only by physical treatment—for example cancer or glaucoma, so these followers of Bates presume to treat all sorts of eye conditions by taking away glasses and giving exercises usually with a large admixture of mumbo-jumbo quite satisfactory to the ignorant and, therefore, gullible portion of the public. When glaucoma or cancer is treated in this way, of course, irreparable harm is done.

Conclusions

Seeing is one half physical; it deals with the formation of a good image on the retina and the co-ordination of the two eyes by proper movements of the eyes in fixation and fusion. The other half is mental or psychical and deals with the perception and interpretation of the sensations produced by the images on the two retinas. The first is what goes on in the eyes; the second is what goes on in the brain.

To improve the physical part—the image formation and the fixation and fusion—is the daily task of eye specialists. They do this chiefly by the skillful use of glasses.

To improve the mental or psychic part requires training, teaching, exercises, practice. These are well known to be the indispensable and efficient means by which one learns to see and also learns to do a thousand other things that have to be learned before they can be well done. This side of the problem of seeing has been neglected by ophthalmologists, who were absorbed with other fascinating problems of seeing whose solution is more direct and precise, more mathematical. A natural result is that the problem of the mental, psychical side of seeing has been seized upon frequently by irregular practitioners. Do not infer from this that no ophthalmologist pays attention to the mental side; that would be a gross error. The treatment of psychical difficulties is obviously not at all a clear-cut, mathematical problem. It calls for insight, sympathy, tact, wisdom as distinguished from learning.

To reach the psyche, it has been found by many a clever worker, some of whom are charlatans, that foolish gestures and more or less mumbo-jumbo facilitate putting over the simple underlying principles. When these are stripped of their mummery they do not

appeal to the average human intellect, which is incurably superstitious and craves explanations which are not scientific, prefers them, feeds on them. How best to deal with people of that type when they are patients is a far more difficult problem than how to correct a difficult case of refraction and that, in turn, is more difficult than to perform a cataract operation.

The answers to the questions in the title are now obvious: eye exercises do a great deal of good. They are indispensable in learning to see. They may do harm indirectly if they divert a patient with some disease needing treatment of some special kind so that he is led to follow treatment by exercises instead of consulting a competent ophthalmologist and finding out the true nature of his trouble. The limitations to treatment by eye exercises are also clear. It cannot affect certain physical conditions ("which of you by taking thought can add one cubit to his stature"), but is potent in treating the psychic side of vision. It requires a very high degree of skill and acumen to steer a true course, avoiding the neglect shown by many otherwise competent specialists and avoiding the excesses of over-zealous enthusiasts. Truly, "art is long, life is short, judgment is difficult."

The National Industrial Eye Health Program and Its Relation to Vocational Rehabilitation*

Jack Masur, M.D.

THE Society's eyesight utilization program, according to the author, may serve as a guide for a rehabilitation program for the returning visually handicapped (not blinded) war veterans.

THOSE of us who strive to develop vocational rehabilitation as a series of professional services which will offer even more than eyes for the blind and feet for the lame have long hoped for the day when we shall have well developed programs for all groups of disabled—the hard of hearing and the deaf, the cardiac, the tuberculous, the diabetic, the arthritic, the asthmatic, the epileptic, the psychiatric patient, and all others who find themselves in need because of their occupational handicaps. The wheels of a large program grind slowly and it is in just such a program as carried on by the National Society for the Prevention of Blindness that we find the stimulus and the leadership that are indispensable for the encouragement of specific programs with high standards in our state agencies for vocational rehabilitation. The history of the activities of this Society already offers two excellent examples of a successful partnership between a voluntary organization and government: first, the dramatic decline of blindness due to ophthalmia of the newborn; and, second, the increasingly widespread acceptance of the need for sight conservation classes in the public schools.

It is an interesting commentary on our modern society that the successful promotion of a social program designed to better the health or increase the happiness of our people must be based on the economic or materialistic motive. We say "public health is

* Presented at 30th Annual Meeting of the National Society for the Prevention of Blindness, December 14, 1944.

purchasable"; industrial hygiene saves insurance premiums; vocational rehabilitation is a sound investment on a dollars and cents basis; venereal disease control spares us so many million work hours, and so forth. Since we are essentially a practical people, those of us interested in developing programs dear to our hearts shrewdly learned that if it is to have the quality of permanence our approach must be planned in a logical way and that it is more often a matter of opportunity than simply a matter of time. If we do not learn to sell our programs on a realistic basis, then I fear that our results will be as thin as the famous homeopathic soup that was made by boiling the shadow of a pigeon that had been starved to death.

Since this National Society is by its very name dedicated to preventing blindness, which is the king of terrors for the workman, it is altogether appropriate that it lead the way in stimulating the interest of management, labor, government, and ophthalmologists in the extension of sight-saving programs in industry. The war crisis emphasized the importance of sound industrial hygiene practices for the conservation of vision. Young men with excellent vision were being inducted into the services; there was a vast number of new workers unaccustomed to modern machine tools; there was an increasing use of older workers with diminished vision; there was the widespread utilization of chemicals incidental to the manufacture of war products—all of these factors stressed the need for action. It was apparent that there was a great salvage of potential manpower possible in a well organized industrial ophthalmological program. There was need to recognize more generally that when a job needed vision, the man could work only as well as he could see—if only industry could be sensitized to the importance of selecting and placing workers in accordance with an understanding of their visual strength and limitations. The demands of the war effort made it imperative that every worker be hired, that production be increased to the maximum and that spoilage be reduced to a minimum.

The surveys sponsored by the National Society for the Prevention of Blindness included job analyses and a review of plant practices in eye care. The studies revealed indifference in industry to eye conditions, even in plants which had already introduced

general safety practices. A survey of 50 plants employing 166,682 workers revealed that only 10 per cent reported that they had performed job analyses for visual requirements; less than a third of the plants offered visual examinations; and only 14 per cent provided periodic eye examinations. In reports of accidents to safety departments only 22 per cent included a report on the eye condition of the person involved and only 12 per cent made reference to illumination at the site of the accident. The latter points are particularly interesting since it is believed that at least one out of every four accidents in industry is related to faulty vision or poor illumination. The survey also indicated that in the group of plants reported, approximately 70 per cent fitted safety glasses to their workers, but there was little evidence to show educational efforts through unions and supervisors or enforcement through mandatory regulations by management—significant because it is known that 98 per cent of accidents to eyes can be prevented through adequate safety measures.

In April and May of this year, the Society conducted a seminar on the Industrial Aspects of Ophthalmology in New York which aroused a great deal of interest in the joint activities of the Society and the U. S. Public Health Service, and focused the attention of ophthalmologists on the visual bottlenecks confronting our war industries. Our need for a complete eye conservation program is complicated by the lack of a sufficient number of industrial ophthalmologists. The challenge to ophthalmology repeated time and again throughout the conference was to conserve the eyesight of every employed person.

Each year there are over 300,000 industrial eye accidents, of which 60,000 are compensable. These figures are even more striking if we realize that annually approximately 1,000 workers lose the sight of one eye and approximately 100 workers lose the sight of both eyes. It will be recalled that the Society's report pointed out that 98 per cent of injuries to the eyesight of workers can be prevented if the employee is furnished with and will wear the safety glasses or other form of equipment best suited for his work to protect him against flying particles, fumes, dusts, corrosive substances, and glare. It must be borne in mind that there are still other factors resulting in injuries to eyesight: improper illumina-

tion, failure to correct subnormal vision, the exacerbation of early visual difficulties, infections, and failure to diagnose such eye pathology as glaucoma, diabetes, and cataract.

It has been estimated by screening tests that at least 25 per cent of workers have subnormal but correctible vision. In these days it may well be that 40 per cent would be closer to the actual figure.

At the recent Seminar, Dr. R. C. Williams and Dr. Townsend of the U. S. Public Health Service, and other discussants, urged that more industrial ophthalmologists be prepared for the task of assisting management and labor to select jobs suitable to the visual ability of the workers. The U. S. Public Health Service has recognized that the need for ophthalmologic service in industry is as great as the acknowledged need for medical, dental, and nursing services, and has assigned a Service Officer, Dr. Lo-Presti, who is an ophthalmologist, to the National Society for the Prevention of Blindness to assist in the development and conduct of the program of eyesight protection in industry.

The eminent ophthalmologists participating in the Seminar stated that the maintenance of visual fitness and careful evaluation of job placement according to industrial visual skills were fundamental in the industrial program. It may be well to repeat here the outline of a complete program for the conservation of vision in industry:

1. The medical staff of the plant should include an ophthalmologist interested in industrial hygiene.
2. Industry, including the small plants, should have pre-employment vision examinations, using a screening method to conserve the time of the ophthalmologist.

   I might add at this point that we believe that the interests of handicapped persons will best be served if pre-placement examinations to appraise the handicaps of disabled applicants are carefully distinguished from examinations for any other purpose.
3. There should be provision for periodic rechecks. This is especially important because of frequent transfers of workers to new jobs in plants.

4. It is important that there be suitable record system with adequate data on job classification analyses to aid in the proper placement of all potential and present employees. Visual acuity, depth perception, muscle balance, color discrimination, are all qualities of perfect vision, but most jobs do not demand such perfection. It has been pointed out that a worker deficient in any one of these qualities may be sufficiently equipped for a number of jobs in a plant but may be entirely unfit for work that demands particular visual qualifications. It must be stressed that to place a worker with defective vision in a job without proper analysis of his condition or the requirements of the job is to jeopardize the sight and safety of the worker and the quality of his work.
5. Very important is the provision for examination by an ophthalmologist of employees with subnormal vision, for the correction of defects, and furnishing glasses as indicated. The corrective measures should provide visual acuity as nearly normal as possible for the particular job. Personal glasses fitted for reading at the usual distances are generally quite different from the working distance at the bench or machine tool.

   In addition to the correction of refractive errors, the medical examinations will include the diagnosis of general diseases with eye manifestations and the diagnosis of specific eye conditions such as trachoma, iritis, glaucoma, etc.
6. Protection programs should place emphasis on continuous application through educational methods and mandatory regulations.
7. Most obvious of all is the necessity for an intelligent first-aid program to provide expert care of the eye for foreign bodies, lacerations and punctures, burns and scalds, and bruises and contusions.
8. We are beginning to understand more about the need for study of adequate illumination to improve the visibility of industrial jobs. It is well known that eye fatigue is a cause of industrial accidents. Proper brightness with an understanding of brightness contrasts and ratios will yield a greater

factor of safety. Illumination engineers remind us that lighting helps those who need help most—particularly the older workers.

9. Little attention has been paid to the study of occupational lenses. We should remember the importance of subnormal work distances as they relate to normal visual distances. The further development of the use of occupational correction of vision is likely to yield excellent dividends in production as well as the conservation of eyesight.
10. We are learning that there should be special consideration of specific visual problems, such as color discrimination and depth perception.
11. We must stress the evaluation of problems of vision as they relate to general health: ventilation, posture, nutrition, domestic and social relations. Here as well as at every other point in this program there is need for close teamwork between the ophthalmologist, management, safety engineers, and other members of the medical department.
12. Finally, ophthalmologists need to study medico-legal relationships to understand the relationships of labor and management to the eyesight conservation program.

We believe that one of the most significant advances in the field of vocational rehabilitation was the pioneer work of the Minnesota group in the development of the concept of Selective Placement in conjunction with Physical Capacities Analysis. The adoption and extension of this technique by the War Manpower Commission and certain large industries, particularly the shipyards, mark a new era in the utilization of disabled persons in industry. The concept emphasizes "capabilities" rather than "disabilities." A disabled worker who is well placed is no longer handicapped. A person's ability to perform a given job is not dependent on his over-all physical makeup, but rather on his skill, aptitude, and experience. A preplacement medical examination plus an analysis of the physical requirements and environmental conditions of a job are the elements of the selective placement method. There have been some questions raised concerning the paucity of satisfactory objective tests available to physicians in order to determine the real work

capacity of individuals suffering from various types of disabilities, such as heart disease, tuberculosis, asthma, orthopedic conditions, etc. It has been asserted that physicians are obliged to render arbitrary evaluations based principally on their personal clinical experiences and that we need to develop reliable objective methods for measuring uniformly the physical capacity to perform such activities as lifting, carrying, pulling, climbing, stooping, twisting, etc. However valid these criticisms may be for many categories of physical disabilities, they are probably least applicable to visual disabilities since we are dealing here with one of the more objective medical specialties whereby ophthalmologists employ precision techniques of measurement. We in vocational rehabilitation are, therefore, intensely interested in promoting the use of selective placement and physical capacities analysis methods for the visually handicapped, since it will afford the best opportunity for auditing the long-term effectiveness of these techniques.

We physicians who toil in the field of rehabilitation have to remind ourselves—or more accurately, be reminded by others—that the successful rehabilitation of a disabled person is not solely a medical problem. It is a continuous series of services in the medical, social, and industrial spheres. Rehabilitation has been defined as the restoration of the handicapped to the fullest physical, mental, social, vocational, and economic usefulness of which they are capable. The report of the Tomlinson Committee of the British Parliament emphasizes that rehabilitation is satisfactory only if the disabled person can take and keep a job in normal competition with his fellows. A large proportion of disabled persons can be rendered capable of self-support and of leading a full and useful life—and the Barden LaFollette Act under which our expanded vocational rehabilitation program operates, recognizes this as a public responsibility. Vocational rehabilitation is a public service in the same sense as public health, public welfare, and public education.

It is of the utmost importance that the handicap of disablement not be made worse by lack of understanding, prejudice, and therefore lack of opportunity. In order to secure for disabled persons their full share of opportunity within their capacity for normal employment ordinarily available in the labor market, we should continue to encourage the good will which now exists among

employers towards persons handicapped by disablement. Most important is the necessity for a sustained public relations program to inform employers, labor unions, legislators, and the general public that vocational rehabilitation can fit a disabled person to the job successfully by means of physical restoration, vocational guidance, and training. Employers in particular need to be reassured that under suitable conditions disabled persons can serve effectively without hazard to themselves or others. An excellent example of this type of publicity is the published declaration of attitude by the Association of Casualty and Surety Executives, which encourages member companies to promote the employment of disabled persons. This statement points out that the initial rate for Workmen's Compensation is governed by the industrial classification. Physical defects of disabled persons are not considered in determining that rate, and no higher rate is charged to the employer because of the employment of physically disabled persons. The employment of disabled persons is not prohibited in any way by the terms of Workmen's Compensation insurance policies. Accident experience, good or bad, will ultimately be reflected in the cost of insurance, but the report of the Casualty and Insurance Executives goes on to remind employers that surveys have shown that physically handicapped persons are good workers and that there is evidence that their absenteeism and labor turn-over records are strikingly better than those of the ablebodied; that they have fewer accidents; that they are conscientious, superior workers; that they expect no favors and produce as well or better than the average of normal people.

We must recognize, however, that in the very infrequent cases where handicapped persons sustain serious accidents which result in permanent total disability, the employer is confronted with a disproportionate liability. In all fairness employers who hire handicapped workers should be protected and should be responsible only for the second injury. The remainder of the liability should be borne by industry generally. A sound and adequate Second Injury Fund Law should be in effect in every state to minimize this liability to employers and to assure payment of full compensation to handicapped workers in all cases in which they suffer injury, including permanent total disability.

At this point, I want to refer again to the relationship of the objectives of the National Society for Prevention of Blindness to the activities of our vocational rehabilitation program. An important rôle of vocational rehabilitation borders on the prevention of blindness. Quite literally we have frequently quoted the example of the glaucoma patient to illustrate our interpretation of the word "static" which is used in our Public Law 113 to define eligibility of disabled persons for physical restoration services. "Static" in our interpretation means "relatively stable" or "slowly progressive" or "chronic, but amenable to treatment." Thus we have repeatedly stressed that it would be folly to await the terminal stages of blindness in glaucoma, when the disease had run its course to the final residual state of "static" in the ordinary connotation before accepting the patient for medical and surgical care as a client of the rehabilitation agency. In a more general way, however, we are constantly aware of the obligation of the program to the visually handicapped. If we are to function effectively, our state agencies should make available to their clients with visual handicaps medical diagnosis and treatment of high professional standards, including the services of qualified ophthalmologists and the provision of glasses, expert vocational counseling, skilled vocational training, and selective placement in employment in accordance with the principles of eyesight conservation in industry which we have discussed in some detail here. There is one point of more than passing importance that I should like to mention. The relationship of the increasing significance of chronic diseases in our aging population and their influence on our national economy must be kept before us. The relationships of chronic illnesses to planning programs of vocational rehabilitation and the industrial health problems which arise from the use of a larger and larger number of older workers, are subjects for another day. I do not need to remind you that there is a tremendous increase in the percentages of visual defects in the mature age groups, especially for near vision and muscle balance. The proportions of the problem are indicated by the fact that in 1900 there were approximately 3 million persons in the United States who lived to the age of 65, whereas today there are 9 million who live to the age of 65. Research in the problems of vision made defective by the aging

process deserves the attention of this Society as one of the fundamental research projects in the long-term campaign for the prevention of blindness.

Finally, I want to assure you that we also recognize that we owe a special obligation in the matter of eyesight conservation to all other disabled persons suffering from various types of disabilities. Special attention must be devoted to visual protection in all handicapped persons so that their difficulties will not be compounded. The failure to check a client's vision carefully may result in an unsatisfactory job placement: faulty occupational vision means poor work performances which is equivalent to unsatisfactory vocational rehabilitation.

Why Dark Glasses?

Captain Adolph Posner, Medical Corps, A.U.S.

DESCRIBES the uses and misuse of tinted glasses.

DARK glasses are useful in reducing the dazzle of strong light. However, the promiscuous wearing of dark glasses which has become a fad in recent years, has been directly responsible for many cases of impaired eyesight by creating a false sense of security in the wearer. For it is not generally realized that the commercially available dark glasses protect the eyes only from the visible and ultraviolet, but not from the infra-red, or heat rays in which sunlight abounds.

There was, for instance, Helen, a twenty-year-old college girl who came in one August morning, hardly able to see enough to get about. She had been on the beach the previous Sunday enjoying the warmth of the sun as she lay on the sand, and since she was wearing very dark glasses, she could amuse herself by observing intently the sun from which all this life-giving warmth emanated. When she got home she saw before her a great black ball which covered every object at which she tried to look. This black ball was shaped exactly like a sun; it was the after-image of the sun. She knew from experience that whenever she used to look at a light, she would then see a dark after-image for a short time. But the black ball would not disappear. It remained next day, in fact it became denser and larger. This alarmed her and she decided to see a doctor. Helen had burned the central part of the retina in each eye. This is the most delicate part of the eye, containing as it does, the optic nerves which enable us to read and do other fine work. She did not realize that the heat rays of the sun are not held back by the dark glasses to the same extent as the light rays and that these rays are focussed on one spot in the eye. The eye acts like a

burning glass (a strong convex lens) with which we as children used to burn a hole in a sheet of paper by focussing the sun's rays on it. Helen has recovered some of her vision, but she will always carry with her a dark spot in the center of her field of vision as a souvenir of that sun-bath on the beach.

Helen's condition has not yet been dignified by a popular name because the sun-glass craze has only begun; but we may classify her case with other cases of so-called "eclipse blindness." From time immemorial people have been fascinated by the phenomenon of a solar eclipse. They would smoke a piece of glass over a flame and observe the progress of the eclipse through the smoked glass—many a person would thus burn a hole in his retina and would be rendered unable to enjoy the next eclipse.

Eighteen hundred years ago, Galen (131–201 A. D.) had already called attention to the fact that "at the eclipse of the sun, a very great many who attempted to secure an all too exact observation of the phenomenon, and therefore gazed immovably at the sun at last became completely blind, without perceiving that there was anything the matter." The adverb "completely" is an exaggeration; but then Galen was a forceful writer and sacrificed accuracy for dramatic effects.

To protect the eyes from the harmful effect of heat rays, there are special goggles, such as those which are worn by welders and glassblowers. In general, a glass which is rich in iron salts absorbs heat well. However, such glasses are not on the market as sun-glasses. They are too expensive and too heavy for comfort. The simplest preventive measure is to wear light colored sun-glasses, or none at all. Then it will not be possible to look directly into the sun.

Another ray which is harmful to the eye is the ultraviolet ray. Like the heat ray, it is invisible. It is therefore wrong to speak of ultraviolet light. The greenish color of an ultraviolet-ray lamp is not due to the ultraviolet, but to certain visible rays it emits. Sunlight contains a great deal of ultraviolet radiation. The best artificial source is the glow of mercury vapor.

The spectrum of mercury vapor contains no red rays, so that red lips look black and faces take on a ghastly appearance. The ultraviolet rays have a shorter wavelength than visible light. They cannot pass through glass, so that the bulb of the lamp must be made of quartz

instead. Neither can ultraviolet rays pass deeply into the eye. They are entirely absorbed by the cornea, which is the first structure they meet. They give rise to a painful inflammation of the outermost layers of the eyeball (conjunctiva and cornea), characterized by tearing, and inability to keep the eyes open. This condition is known as electric ophthalmia and used to be common among motion picture actors, since they cannot wear protective goggles while they are on the set, exposed as they are to a flood of electric lights. It is now possible for actors who are unusually sensitive to ultraviolet rays to protect their eyes by wearing tinted contact glasses. These are little glass shells which are worn behind the eyelids and are invisible because they fit directly on the eyeball. When taking ultraviolet treatments or sun baths, it is important to wear goggles which are either amber colored or gray. (Even colorless glasses filter out a large percentage of ultraviolet rays).

Mountain climbers who don't protect their eyes with goggles often get a swelling and inflammation of the eyes. This is caused by the ultraviolet rays reflected from the surface of the snow. It is known as "snow blindness." Eskimos and even their dogs are not immune from this condition.

There is another, much more serious condition, which is also sometimes called "snow blindness." Here, the inflammation is not the essential feature, but there is an actual loss of sight. It occurs among soldiers or adventurers who have wandered for weeks in the cold and who are poorly supplied with food, especially if they lack vitamin-containing foods such as fresh vegetables and fruits. These people develop an avitaminosis, which, in addition to cold and the reflection of light by snow, produces a weakness of the optic nerve, so that the subjects become either partially or totally blind. A lack of vitamin B^1, or thiamin chloride, is chiefly responsible for this type of blindness which is known technically as "optic neuritis." Galen relates an excellent example of such snow blindness probably caused by cold, fatigue, and lack of vitamins.

"Remind thyself how the power to see is hurt by a bright and dazzling ray; how the eyes of Xenophon's soldiers suffered, who had to march so long over snow covered fields. Yes, perhaps thou knowest nothing about it and hast never disturbed thyself about Xenophon."

And finally, an example, also from Galen, of how light alone may affect an exhausted, starved organism; although the story should be taken with a grain of salt: "I believe that neither hast thou ever heard of Dionysius, tyrant of Sicily, who had a small structure erected over his prison, which he kept bright and shiny by having it washed with chalk. Into this structure he led his prisoners after a long confinement in the dungeon; and when they who were suddenly transported from darkness into brilliant light, looked into the splendor with joy, they were completely blinded."

It is interesting to note that while the heat rays from a distant object like the sun can burn a hole in the retina, heat coming from a diffuse and near-by source, such as the glass-melting furnace, is absorbed in the front part of the eye and heats up the lens of the eye producing cataract. "Glass blower's cataract" is an important industrial disease which can be prevented by use of protective goggles.

The extraordinary prevalence of cataract in warm countries such as India, can probably be accounted for by the hot climate, combined with inadequate nutrition.

Colored lenses have been used since the middle of the 16th century. The first colored lenses were green. In the 17th century, blue glass was introduced; but it was not until the middle of the 19th century that it became immensely popular because of certain life-stimulating properties which were found to be contained in the blue rays of sunlight. These blue glasses, thus, were not worn to protect the eyes from the effects of light but rather to "stimulate" them. Fortunately, they did not transmit the short ultraviolet rays which are injurious to the eyes. Blue glasses are rarely worn today.

Gray, or smoked lenses were first made in London in the middle of the 18th century. They are still known by the name "London smoke." Amber lenses were first made in England in 1832.

Then came an avalanche of lenses of various colors, each designed to absorb a definite portion of the spectrum. In 1913 Sir William Crookes, the inventor of the Crookes vacuum tube, devised a green lens which would absorb both the ultraviolet and the infra-red ends of the spectrum. The lens now popular as the "Crookes lens" is brownish gray and absorbs only ultraviolet rays.

The color in a lens is produced by mixing salts of various metals with the glass. Cobalt oxide gives the glass blue color; chrome oxide

and ferrous iron oxide give green; gold oxide, red; Didymium, salmon pink, silver oxide and uranium, yellow; manganese, violet. All heat-absorbing glass contains a large amount of ferrous iron oxide.

Ordinary colorless crown glass lenses transmit 80% of all light rays. They give partial protection against sun-burn, since they hold back completely the short ultraviolet rays, which are the most dangerous. Brownish gray lenses absorb the short as well as long ultraviolet rays and are thus useful protective glasses for mountain climbing. Flesh-colored and smoke (gray) lenses diminish the total quantity of light more or less uniformly over the entire range of the spectrum and should be worn by persons who are exceptionally sensitive to the dazzle of reflected light. Green and bluish-green lenses absorb both the short ultraviolet and some of the infra-red rays. They are to be preferred for flying goggles and for beach wear.

Recently, lenses with polarizing properties have been offered as sun-glasses. They are of value when dealing with polarized light only. Reflected glare from water or wet pavement is partially polarized, especially if it makes an angle of 20–30 degrees with the reflecting surface.

A few practical suggestions concerning the choice of dark glasses may be of service to the reader.

1. Dark glasses absorb light uniformly in the entire field of vision. Hence they do not eliminate glare, which may be defined as a localized intensely illuminated area of the retina.
2. The usual sun-glasses do not offer protection against the heat-rays of the sun.
3. The choice of the type of glasses should be entrusted to the judgment of a competent physician.
4. The light shades of tinted lenses are of little practical value, while the very dark shades should be avoided because of the danger of burning the retina.
5. Sun-light of not too great an intensity is not in itself deleterious to the eye. Certain individuals may be unduly sensitive to light, but in all such cases a medical examination is indicated before resorting to sun-glasses.
6. Finally, the indiscriminate use of sun-glasses as a fad of fashion, and their promiscuous sale by drug and cigar stores is to be condemned.

Measurement and Prevention of Eye Flash

Philip Drinker, Sc.D.

THE subject of eye flash is an important one in the consideration of eye safety, especially in the shipbuilding industry, and the author points out in this article various means for the prevention of eye damage from this cause.

IT HAS been reported recently[1] that some 40 per cent of the calls at shipyard dispensaries and first-aid stations are for eye injuries. In new yards, with inexperienced workers, about half of these calls are for "eye flash." This is an unfortunate misnomer but a term which is free of all ambiguity—the doctor, the patient and everyone else knows precisely what is meant.

The burns which can and do occur occasionally from flashes are the result of a sudden heavy discharge of current through a fuse, circuit breaker, or the like—a real flash, with the power almost of an explosion, vaporizes the copper conductors in a momentary blaze and persons nearby may be severely burned.

Protective Glass

In arc welding, nothing comparable occurs. It is well-known that the electric arc, regardless of the electrodes used, is fairly rich in ultraviolet light. The cutting flame of the acetylene torch also gives off ultraviolet. Both the electric arc and the gas torch have such high intrinsic brilliancy that they should not be viewed without the aid of proper goggles or of special glass in the welding shield.

The specifications for such glass have been developed and approved by the Bureau of Standards and adopted by the American Standards Association.[2] We have no criticism of these standards and no fault whatever to find with their use during welding, cutting, burning and even shrinking.

Most workers are cautioned not to look at the welding arcs and no welder would try to weld without his welding shield. Also, he knows he can get a nasty burn, like sunburn, on his arms and neck if they are not covered. But when he flips up his welding shield to change rods, he is very apt to receive the ultraviolet rays from his neighbor's arc.

If he is near enough and the exposure is long enough, he knows he will be burned, especially in his eyes. But it does not happen in a "flash"—it takes a surprisingly long time unless he is within a few feet of the arc.

Distance and Exposure

The question we have been asked repeatedly is: How near must one be to get an eye burn in a reasonable length of time? It was evident from the medical literature that no one had ever troubled to determine the precise relationship of time and distance which we needed to know in our shipyards.

The monograph by Verhoeff and Bell[3] describes in great detail the effects on the eye of various radiations. These authors showed that the biologic response varies inversely with the square of the distance from the source of radiation and directly with the time of exposure. They showed further that, within a 24-hour period, the effects were cumulative.

Their experiments were done with a mercury vapor lamp and a magnetite arc. So far as we know, no one had attempted to define in practical terms the time-distance relationship which applies to modern arc welding.

Drs. Kinsey and Cogan, at the Howe Laboratory of Ophthalmology of the Harvard Medical School, performed with an electric arc welding set a series of experiments[4] and determined the combination of distance and time necessary to produce minimal ocular lesions in rabbits, dogs and men.

Light Meters

It was found that a simple way of measuring dosage was to measure illumination at the subject's eyes by means of a light meter such as is commonly used in photography. This meter is intended to be used with visible light, but it was found by compar-

ing readings with those of an ultraviolet meter that the ratio of ultraviolet to visible did not vary significantly with changes in electrodes or with changes in operating current and voltage.

Therefore, if we find that a typical shipyard welding unit will just cause a perceptible eye flash in man, when viewed at 7 feet for 20 seconds, we know that at 50 feet a comparable exposure will be $\left(\frac{56}{7}\right)^2$x20 seconds or 21.3 minutes.

A number of us, without any protection, looked directly at welding arcs for ten minutes at 50 feet without any burn resulting. Obviously we played safe as the dosage we used was less than half that of the computed threshold.

The welding expert will object that what we call dosage can be varied according to the way welding is done and again with the equipment, current, and voltage available. This criticism is just and to take such variations into account one should measure the intensity of illumination caused by the arc at the point where the possible eye flash is to be studied. In bright daylight, the light from the sun interferes with such measurements, but in the holds of ships, in shops, and at night there is no appreciable interference by extraneous light.

Protection

No one can say just how many minutes daily of unprotected exposure to welding arcs the average shipyard worker experiences. Arbitrarily we chose ten minutes, but it might be argued that the figure should be more or less. At 50 feet, the average man will need over 20 minutes exposure to show any real evidence of eye burns, and at 100 feet he would need 80 minutes, assuming typical shipyard welding arcs.

The ultraviolet screening effect of ordinary glass, including that in all types of eyeglasses and safety goggles, is so good that eye flash virtually is non-existent among workers who wear glasses. All shipyard men know that the yards can not be lighted up like factories so that colored goggles may offer an annoying and sometimes serious risk of accident.

We would welcome a more logical system of issuance of goggles; that is, issue the colored anti-flash goggles only where there is a

definite need for them, such as to men constantly exposed to indirect radiations from electric arcs. Most shipyard workers would be adequately protected by hardened lens safety goggles with side shields.

But all goggles to be worn near welding operations should be equipped with side guards for protection against foreign bodies.

In conclusion, we would like to point out that it was not our intention to investigate the diagnosis or treatment of eye flash. For that we would refer the reader to the paper by Dr. Rieke given before the Occupational Disease Session of the 32nd National Safety Congress.

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Medical Social Work in Sight Conservation as Developed in the State of Washington

Elizabeth T. Mills

DESCRIBES how the Department of Social Security carries on sight conservation in one State.

IT IS significant that the chapter of Washington's 1937 Social Security law which established the Division for the Blind is entitled "An act establishing within the Department of Social Security a division for improving the condition of the blind *and for the prevention of blindness* . . ." Continuously since 1937 Washington's program of services for the blind has been accompanied by statewide effort in prevention of blindness and in services to the partially sighted. During the seven years of its history the program has developed and changed according to needs in the state, but in general has had five main emphases: eye treatment and surgery, work with schools in behalf of visually handicapped children, medical social work consultation to welfare and health agencies in relation to persons with eye difficulties, community education for prevention of blindness, and legislation to protect sight and improve services to the partially sighted.

As a medical social worker looks at this seven-year program she finds her attention diverted from facts, figures, and charts to the human stories which illustrate the vital substance of any public program, and its justification.

> S. D., 60, had been unemployed for five years following accidental amputation of his left arm, though previously he had been a successful cement worker. Gradually he began to lose sight in one eye from a cataract. Since he still had normal sight in the other eye, surgery was not immediately authorized, but as cataract developed in the other eye as well, the services

of an eye surgeon were made available, and a successful cataract extraction was done, and vision of 20/25 with correction secured. Mr. D. subsequently applied for and secured work as a janitor in the laundry of a large Army hospital near his home, and is reported by the personnel office of that institution to be doing very satisfactory work. The county welfare department visitor commented by letter, "Though we have nothing more sensational to report than the above information regarding his recovery, the fact remains that while just before his eye surgery he could not do even ordinary labor of any kind, today he is supporting himself and his wife while at the same time contributing to the war effort."

H. M. was 12 years old when he came to our attention. His family had paid as private patients for repeated needlings of H's congenital cataracts. After they lost their farm during the depression, however, they could no longer afford private eye care. Through the eye treatment and surgery program H. was enabled to continue under the care of his own ophthalmologist and had another needling. When he suddenly developed a partial detachment of the retina in one eye, authorization was immediately given for re-attachment of the retina, and this operation was successful in restoring sight in the eye to its previous level, 20/100. Consultation has been given the local high school in sight-saving methods which will help meet H.'s needs, and school authorities have co-operated fully in an individualized program in which he is making good progress. His chief vocational interest is in farm work and he is taking the vocational agricultural courses in high school.

The medical social work consultant on a state staff cannot know in detail the individual reactions of the persons receiving service through the prevention of blindness program, as she does when carrying her own caseload in a hospital or clinic. Usually she does not see the person for whom she helps to arrange eye treatment and surgery, or in whose behalf she gives casework consultation to a county welfare department visitor. She is often conscious of the gaps in her knowledge of results of services given. Measuring the amount of service is never easy, but knowledge of even one patient whose sight has been conserved or restored, or one partially sighted child whose educational and social adjustment has been helped, is compensation.

The eye treatment and surgery program of the Division for the

Blind is designed to make available expert services to any person in need of eye care for which he cannot himself pay or which is not available to him through other resources. The primary purpose of the treatment program is to restore and conserve sight. It does not cover care of general conditions such as diabetes, brain tumor, or kidney disease in which the basic cause of difficulty is outside the eye itself. However, it has recently been extended to include treatment of strabismus cases even where the effect of care is primarily cosmetic benefit rather than sight conservation. Requirements as to financial and residence eligibility are sufficiently flexible so that no individual will be deprived of needed care on technicalities alone. It is the purpose of the program to avoid in the future any such case as that reported before the program became widely known in the State. A young man in his late twenties was injured in an accident in the woods when he was struck on the head by a falling tree branch. The next day he noticed some dimness of vision which became progressively worse. However, he did not feel he had sufficient funds to consult an eye specialist and he did not come to the attention of the Division for the Blind until almost four years later, when he was totally blind because of bilateral detachment of the retina. This was too late to permit corrective surgery, and life as a blind person is the only possibility for him.

Community Responsibility

In general, local communities are expected to continue to carry responsibility for eye care for simple refractive errors since resources for this are already available locally in most instances, and the budget of the Division could not cover the cost of simple refractions needed. Where there is any reason to suspect existence of a more serious eye condition, a case may be referred to the Division through one of the county welfare departments, and examination by an ophthalmologist at the expense of the Division authorized.

Eye examination, office treatment, surgery, hospitalization, artificial eyes following enucleation, and in some instances glasses are provided. The actual size of the program has never been very large, and the largest number of patients was cared for in the earlier years of operation, when it was necessary to take care of a backlog

of cases accumulated during the years before an eye care program was established.

When the Division's advisory committee of ophthalmologists set up the program for eye care, their first concern was for adequate standards. This culminated in the fall of 1941 in the requirement that eye surgery done under the program be performed by a physician certified by the American Board of Ophthalmology. This requirement tended to concentrate care in a smaller number of communities in the State, since diplomates of the American Board are resident in only nine cities of the State. However, at no time has there been any great difficulty in arranging transportation for a patient to a city where such an ophthalmologist was available.

In the last biennium for which figures are available, 1941 to 1943, a total of 86 individuals received 106 eye treatments and surgery procedures. These included 31 persons under care for cataract, 21 persons under care for glaucoma, 5 persons under care for strabismus, and 30 persons under care for a variety of other conditions. Thirty-six people received care for conditions in which some improvement or restoration of sight might be anticipated. Of these, final reports showed that after eye surgery 24 had vision above 20/200, 10 had vision not improved to above 20/200 and for 2 reporting was incomplete. Among the 24 are the 2 patients described earlier in this article.

Medical Social Worker in State Eye Program

The place of the medical social worker in eye treatment and surgery in Washington has been in some ways similar to and in some ways different from the job of the medical social worker in an eye clinic or hospital. Cases become known to the medical social worker through correspondence rather than by direct contact, being referred in all instances from the county welfare departments, which are the local units of the State Department of Social Security. The medical social work consultant in the Division is responsible for reviewing applications for care, and securing additional information where necessary, as well as checking financial eligibility on the basis of data submitted by the county. She then submits the report of eye examination with other pertinent documents such as medical social data sheets to the Technical

Consultant of the Division, who makes authorization for eye treatment or surgery. The medical social work consultant then makes arrangements with the county welfare department to see that the authorized care is given by eye physician and hospital. Follow-up procedures are handled by clerical staff in the Division under supervision of the consultant. As seems advisable during the period of care, consultation on medical social aspects of service to patients with eye difficulty is given, primarily through correspondence, but occasionally through direct consultation with the county welfare department staff member and in some instances with the patient when the consultant is in the county. Eye care is thought of always as a part of total service to an individual, and is integrated with such other services as educational adjustment, vocational counselling and training, and social case work service. Through the consultation contact, the county welfare department staff members are helped in understanding general implications of eye disease and steps they can take toward sight conservation, and effort is constantly made to stimulate them to awareness of actual or potential eye difficulties and the importance of making eye care available.

Sight Conservation in the Schools

From the beginning, the staff of the Division has emphasized the sight conservation of school children. In recent years this emphasis has been carried on in close co-operation with the State Departments of Health and Public Instruction, in a most productive three-way relationship. With specialized personnel available, the Division for the Blind has taken a good deal of leadership in statewide programs, some of which have later been carried on by the other departments. Case finding has been recognized as the initial problem in sight conservation of school children. Studies over a period of years finally developed the conclusion that responsibility for case finding of children with eye difficulties must depend primarily on the classroom teacher, who does initial screening with the public health nurse available as an expert for consultation and supervision. This conclusion was reached after it became apparent that there were simply not enough school nurses in the State to assure adequate surveys of school children for possible eye difficulties. Accordingly, the Division for the Blind prepared a pamphlet on "Vision

Testing of School Children" drawing on the best published sources, and using a good deal of the time of the ophthalmologist who is Technical Consultant to the Division. This pamphlet was sponsored jointly by the State Departments of Social Security, Health, and Public Instruction. After its publication, copies were distributed to every public school in the State and to all public health departments so that it might be widely available both to classroom teachers and to school nursing personnel. That it met a real need has been evidenced from comments which have come in to the Division—further experience will indicate the ways in which it can be used most helpfully.

Experience in Washington also brought the conclusion that a case finding program for children with eye difficulties was useless unless accompanied by provision for examination by eye physicians as indicated. Naturally, the majority of school children who are found in the testing program to have symptoms suggestive of eye difficulties will be able to secure this care through financial provision by their own family; however, there will always be a minority of children whose families cannot afford the services of eye specialists. Study in various communities in the State indicated that the chief stumbling block in the case finding program was a satisfactory means of getting a report from the examining eye physician. A new report form to be made available to persons referring school children for examination by an eye physician was therefore worked out by the medical social work consultant and technical consultant, with the advice and comments of the other advisory ophthalmologist. The upper part of this form has space for certain identifiying information and medical history to be filled in by the referring person. The lower half has space for the eye physician's report, and is arranged in check-list form so far as possible.

Sight-saving Classes

Since many of the ophthalmologists in the State have not had experience in working with sight-saving classes, the report form includes a statement of the type of eye difficulty for which sight-saving work is commonly recommended. The form has been made available particularly to the school nurses, who can use it in refer-

ring children to eye physicians for examination, and can then refer the completed form to the appropriate State Department, if sight-saving work is indicated. Various provisions for free eye examinations for children whose parents are financially unable to pay for care have been worked out in different communities in the State, using funds from service clubs, school clinics, Parent-Teachers Associations, etc. Where children have more severe eye difficulties, the eye treatment and surgery program of the Division for the Blind is available. However, this is not used extensively for care of school children, because, in the great majority of cases, their problems are relatively simple, and are taken care of through local community arrangement.

Only the three largest cities in the state—Seattle, Spokane, and Tacoma—have established regular sight-saving classes. The problem of partially sighted children in the rest of the state has therefore been an acute one. The Division has stimulated and participated actively in programs to locate partially sighted children, and to help communities work out an acceptable plan to meet the need of individual children when they are located. Some children from rural or semi-rural districts have been placed in boarding homes in one of the three cities in order to attend sight-saving class, but this procedure has not been followed extensively. Case finding efforts to date have not located numbers of partially sighted children approaching any of the published estimates as to incidence of this type of handicap in the school population nationally. In one county in the state where an active ophthalmologist had advised sight-saving class work for a number of myopic children, rather extensive planning was done with local school authorities for establishment of a sight-saving class, but final steps could not be taken because of lack of availability of a trained teacher and of any classroom, when the town became crowded by war industry population. In another of the more populous counties of the State enough partially sighted children have been located to indicate that a sight-saving class should be established in the near future, and state and local personnel are working toward the objective of setting up such a class.

At the same time that efforts have been carried on to stimulate provision of sight-saving classes in communities having enough partially sighted children to justify that procedure, there has been

recognition of the great need for service to the isolated child with a visual handicap. The method of meeting this need has been through direct consultation to school personnel in the child's own community. Upon request, either directly to the Division for the Blind or to the State Department of Public Instruction, the Medical Social Work Consultant visited a school reporting partially sighted children, after an eye physician's report had been received indicating that the eye condition was such as to warrant sight-saving work. Advice was then given as to physical requirements in the classroom, materials such as stereotyped books, special charts, pencils, paper, and reference lists of other school materials suitable for sight-saving students. Lighting in the classroom was measured by a light meter and suggestions given for window shade equipment, position of children in the rooms, and so on.

During the 1941–1943 biennium school visits were made in 16 of the 39 Washington counties, on behalf of 20 partially sighted children.

One special project carried out by the Medical Social Work Consultant consisted of visits to schools to which partially sighted children were returning from the State School for the Blind. One of these visits was made in company with a staff member of the State Department of Education, and the others alone. These children had been incorrectly placed in the State School for the Blind under an earlier admission policy, and it was recognized that their return to schools in their own community involved a number of problems. In instances where the vision was such that sight-saving materials would be needed, inspection of the school was made by the consultant, and advice given to school personnel on needs of the staff and on sight-saving materials and procedures. These visits usually took the form of consultation with school nurses, supervisory personnel, and classroom teachers in which there was thorough discussion of the child's physical, social, and educational needs. Excellent co-operation was received throughout from the school people and it was felt that sound preparation was made for return of the school child to a more normal educational experience with other sighted children.

The grade placement of children referred has ranged from first grade to third year in senior high school. (In the latter instance,

consultation was ineffective in bringing about adequate adjustment of the student who had so poor a background of being passed from one class to another without adequate learning, because he couldn't read the regular type books, that his handicap could not be overcome through service available).

The prevalence of consolidated schools in the state, and provision of state aid to local school districts has been extremely helpful in getting adequate services to children in rural areas. It was in one of the smaller towns in the state that the consultant first saw schoolroom lighting with photo electric control. She has become something of a missionary on schoolroom lighting, proper window shades, and against glare-producing objects in the classroom. One of the more interesting examples of glare discovered was in a very modern school building situated a few blocks up a hill from one of the larger lakes in the state. The teachers had to keep the blinds pulled on the west windows facing the lake most of the time, because of the degree of reflection from the water.

Until the summer of 1943 this school consultation program for partially sighted children outside of the three largest cities of the state, was a function carried almost exclusively by the Division for the Blind, although we received co-operation from the State Departments of Health and Public Instruction. However, under the new legislation providing for a supervisor of education of the physically handicapped in the State Department of Public Instruction, the function of consultation to schools on classroom problems of the visually handicapped is being transferred to the State Department of Education. A special supervisor on sight-saving work in the State Department of Education has not been appointed nor has there yet been proven a sufficiently large number of children to be served to warrant such a special supervisor, so that responsibility for special planning for our physically handicapped children rests as a co-operative program among the state departments.

Early in the course of the Division's work on eye health of school children, it became apparent that more understanding of this subject needed to get to teachers. It was agreed among the state departments concerned that the wise approach was to bring this contact to teachers in training through the state teacher train-

ing colleges. Accordingly, since 1939, there has been a series of meetings with classes in teacher training colleges to discuss eye health in the classroom; at first the approach was through health education classes, but the most recent consensus of opinion has been that it is wiser to present this material to senior students in practice teaching classes as a part of their consideration of the total health of the child, shortly before they go out into actual teaching jobs. In these meetings with teacher training students a number of different devices have been used. Printed and mimeographed material, including bibliographies and instruction on vision checking in the classrooms, has been distributed; the colored movie on sight conservation produced by the Division for the Blind was frequently shown, and when possible two successive class meetings were arranged, one with an ophthalmologist, the other with the Medical Social Work Consultant, with each discussing the aspect of eye health in the classroom appropriate to his own professional background. The experimentation done to date has been valuable in indicating the most useful approach, and in stimulating joint planning by health, education and welfare in this area. This experience has been pointed up and guided by annual meetings of representatives from the departments concerned and the state teachers' colleges, with representative ophthalmologists in the state participating. Through these aspects of sight conservation work in the Division for the Blind has developed the frequency of infinite productive contact between division personnel and personnel of the State Department of Public Instruction and State Department of Health.

As indicated earlier, an important function of the Medical Social Work Consultant has been to advise visitors in county welfare departments on problems of visual handicap. In staff meetings, when sight conservation was the principal subject for discussion, stress has been laid on early recognition of actual or potential eye difficulties, and ways in which the visitor can help people to utilize medical care. On a case-by-case basis, interpretation has been given on the reaction of the individual to the experience of illness and to physical handicap. Some of this consultation has been through correspondence, some through direct visits—more visits to counties have been in connection with educational

and promotional functions of the Division than in case consultation alone. Another rôle the consultant has occasionally played has been that of integrator of services to meet the needs of a given individual. A case demonstrating this function most vividly is that of D. C.

> D. C. was referred at the age of 13 by the State School for the Blind, where she had been a student for about a year. D. is a diabetic youngster who came from a broken home and who consistently failed to maintain adequate diabetic management. She was an extremely intelligent, alert, and attractive child. Her future health and happiness seemed greatly imperiled by inadequate planning and care at the present. After conference with the State School for the Blind and the county welfare departments concerned, the consultant arranged for D.'s admission to a small treatment center for emotionally disturbed children where medical supervision would also be given. D.'s eye condition, juvenile diabetic cataract, was carefully explained. As a child with very deep-seated emotional difficulties, she remained in this institution for about a year and a half making somewhat fitful progress, but gradually learning a more responsible behavior pattern and to relate more normally to other people, as she overcame reaction to her experience of childhood rejection. She was under the care of an ophthalmologist during her period of case work treatment and had one needling which was quite successful. She attended regular junior high school near the institution, and managed without sight-saving materials or procedures although these were available, if needed. In this instance, her achievement was based on superior intelligence and interest in school work despite limited vision and a diabetic condition which required insulin.

Community Eye Health Education

Another important function of the Division for the Blind since its inception has been a program of community education on sight conservation and prevention of blindness. This has been participated in by all personnel of the Division, with special responsibility resting on the Medical Social Work Consultant. Many types of activities have been carried on. Talks before community groups have been of considerable importance. Such groups have included service clubs, nurses' organizations, Parent-Teacher Associations, community councils, Teachers' Institutes, etc.

Material used in these talks since 1941 has included the color motion picture on sight conservation which was prepared by the Division. Photography was done by a staff member of the State Department of Social Security with considerable experience as an amateur photographer, and the scenario and editing were done in close co-operation with Division personnel, who also assisted in setting up the scenes.

The effectiveness of visual education has been aptly demonstrated by this motion picture, which has been very well received by groups ranging from 6th and 7th grade health education classes to high school students, service clubs, county welfare councils, health and welfare departments, sorority alumni organizations, Junior Womens' Clubs and many other groups. Ultimate values of such efforts at community education are, of course, not easy to judge. They have, however, brought the Division a number of requests for service, and have helped to mobilize an informed public opinion in support of needed legislation.

Legislation

Two achievements in the way of social legislation relate particularly to sight conservation and services to the partially sighted. In 1941 the Legislature passed a bill providing for a serological examination of all expectant mothers during the period of prenatal care. In 1943 a bill provided for the establishment of a division for the education of handicapped children in the State Department of Education, and provided money for hiring the personnel and purchasing special sight-saving material for establishment of a lending service to be used by local schools. The Supervisor of the Division for the Blind was active in the securing of this legislation and in gaining support for it, as well as in planning for its implementation later. All personnel of the Division, as opportunity offered, interpreted the advisability of such legislation to community groups and undoubtedly gained some support for the measure. A supervisor of education for handicapped children was appointed in the Department of Education in August, 1943, and the program is in process of development. Although there had been a good deal of interest in special education or education of

the exceptional child on a statewide level, this was an important step forward.

The other significant piece of legislation relating to sight conservation was a 1943 bill which greatly restricted the sale of fireworks in the state. This was not a complete prohibition of the sale of fireworks, but limited them to the smallest and least hazardous articles. This bill also had statewide support, and while its existence has made less difference during war years when materials for fireworks are hardly available in any case, it will constitute a real measure of protection against eye injury after the war. Previous to the passage of this bill and before the war, several cities in the state had prohibited sale of fireworks, but as roadside stands always sprang up just outside city limits, there was no real control of the sale and use of fireworks.

Summary

The Medical Social Work Consultant's responsibility falls in the two definite fields (1) the surgery and treatment, individual case plan and follow through with the assistance of the county welfare department (2) the prevention of blindness which is a three-way co-operative program among the State Department of Health, the State Department of Education and the State Department of Social Security, Division for the Blind but looking to the Division for the Blind for initial programming and for practical plans and community contacts in bringing to the public knowledge of eye care and preventable blindness.

Industrial First Aid—Eye Injuries

L. Holland Whitney, M.D.

Nassau County, N. Y.

EMPHASIZES the importance of first aid in the maintenance of visual fitness.

DURING the time taken to read this paper, at intervals not exceeding three minutes (and probably a good deal less), one workman after another in some part of this country will have the anguish of a minor or major eye injury. The causative agent will vary. It may be large or small flying objects, a splashing liquid, flying dust or powder, injurious light rays or intense heat. All of these causes will contribute to this macabre parade of pain and disability.

It is probable that the number and severity of ocular injuries as a result of accidents would be far greater than present statistics indicate, were it not for the excellent natural protection with which nature has provided us. The strong bony walled orbital cavities, the protective layer of orbital fat, and the moveable eyelids all serve to provide a maximum of protection for these vitally important organs.

It has been estimated that in this country during 1941, there was an annual loss to employers, employees and the community in which they lived, of approximately $200,000,000. In these war years with the increased tempo of industry generally, the cost of eye accidents has undoubtedly reached a new high. Even more startling is the fact that the overwhelming majority of these are preventable.

It is generally admitted that the number of cases which have been aggravated at the stage when first aid was indicated is unquestionably large. The well-meaning employee, who attempts to

remove a foreign body from the fellow worker's eye with dirty fingers or a soiled handkerchief, is a common example. Such a procedure exposes the victim to dangers which are far greater than those inherent in the foreign body itself. Probably just as serious in terms of later developments are the simple, minor eye injuries which are neglected by the workman completely, until some complication sets in.

The eye problem in industry can be logically and broadly considered under three headings:

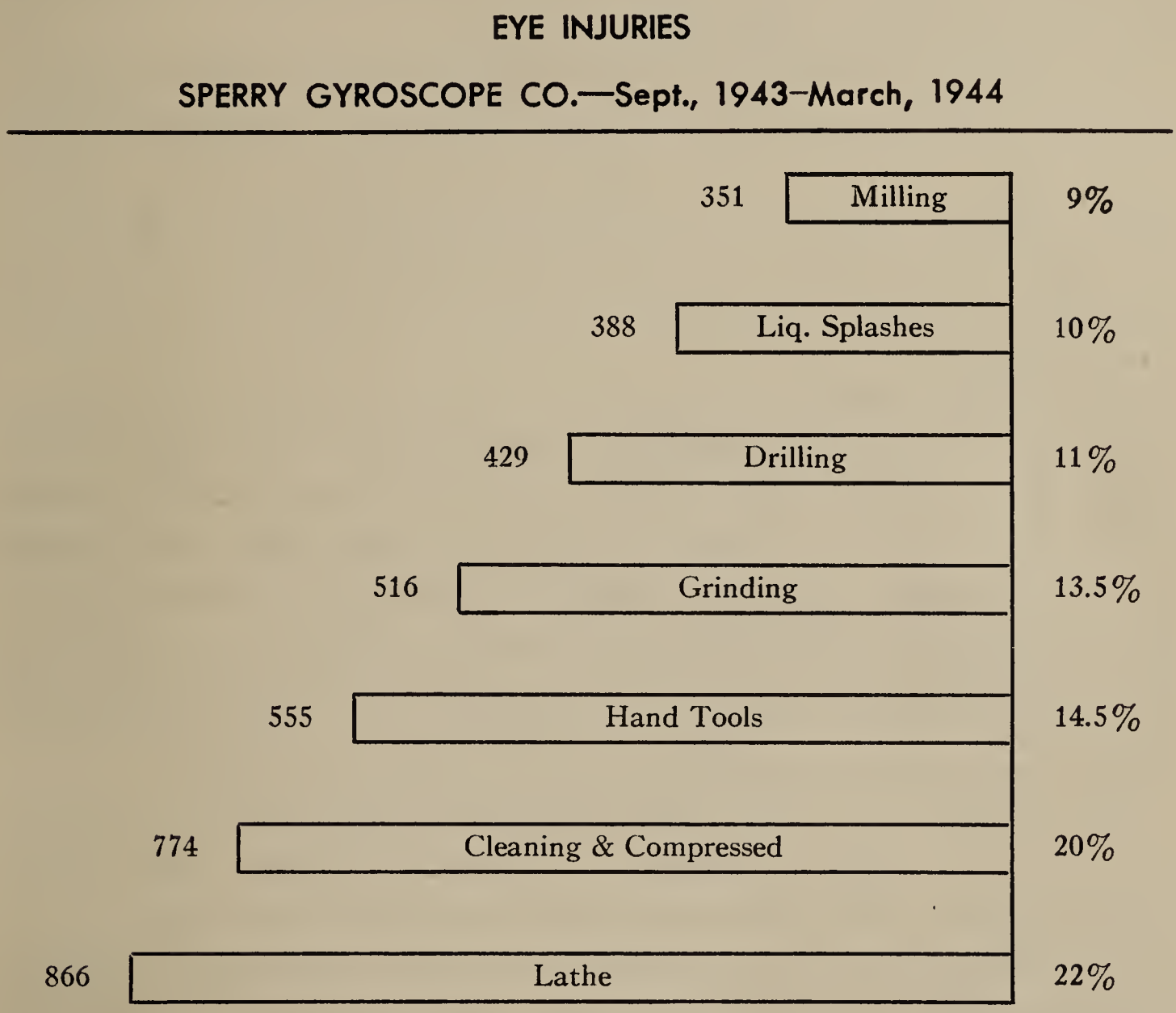
1. Determination of the processes in industry where eye protection is required.
2. A corrective-preventive program rather than a post-accident program.
3. Intelligent first aid and medical care where accidents occur in spite of the first two measures.

The industry with which I am associated is engaged in the manufacturing of precision instruments. We have a modern and well equipped foundry and a representative group of machining, assembly and inspection operations. This is considered a light industrial process and as such we should not have an unusually high incidence of eye accidents. Chemicals and solvents are used only as incidentals to the manufacturing procedure.

A study of our accident experience, however, does not bear out this theory of low incidence. Hand and finger injuries rank first in order, as would be predicted. Eye accidents are second in frequency, whereas average statistics show that they should be eighth or ninth. National figures indicate that 4 per cent of all injuries happen to the eyes. Approximately 12 per cent of all injuries reported to our plant hospitals are eye injuries. The majority of these occur in machining areas from flying chips. Within this machining area lathe operations are responsible for the largest number, grinding operations second and drilling operations third. The assembly areas are largely responsible for injuries caused by hand tools and liquid splashes. The injuries caused by cleaning with compressed air are chargeable to both machining and assembly departments.

Because of the personal discomfort and pain, and the unfavorable effect on production and costs, we have determined to make a realistic approach to our problem. Thus, we are presently engaged

in an eye protection program. In order to assure ourselves that this will be successful, we have approached the problem through two conventional methods. First, an educational program has been launched, with the full support and backing of the Union and supervisory staff. In this way we hope to secure the understanding



and co-operation of the employees. Secondly, we have secured a mandatory ruling that all employees and visitors in the foundry and all machining areas must wear safety glasses. This program is still in its infancy. We have high expectations of the efficacy of such an approach.

Industrial medical departments must be set up to handle the emergency treatment of eye injuries. In our company, registered

nurses are in attendance at all times when the plants are in operation. Special instructions are given on the care of eye injuries and accidents, and every nurse employed is competent to render skillful first aid. As in all first aid procedures, it is not only important that the nurse know what to do but also that she realize her limitations. A high percentage of the total number of eye injuries can be adequately managed in this manner.

The industrial physican should have a better-than-average understanding of eye care, and be prepared to handle the more complicated ones. Here too, it is a rule of our company that any major injury must be referred to an outside ophthalmologist for examination and further treatment as necessary. Such a plan protects the physician and the company and assures the employee of the best available care.

The facilities necessary for proper on-the-premises management of eye cases are not complicated or extensive. The usual sterile cotton and gauze, bandages, eye patches and some simple drugs will usually suffice. A binocular loup, foca-lite and an examining table are desirable where any considerable number of foreign bodies are removed. A small syringe with rubber adaptor or a medicine dropper can be used for irrigations. A blunt spud is about the only instrument which is necessary for ordinary use. A lid retractor is useful under some circumstances but is rarely necessary.

The nature of the eye cases which are seen will vary considerably with the type of industry. Generally speaking, almost any type of injury may occur on occasion in almost any plant. The most common types of eye injury are foreign bodies, penetrating and non-penetrating, lacerations and punctures, burns of all types and scalds, and bruises and contusions. Resnick states that in an analysis of over 4,000,000 compensable and non-compensable eye cases, 90 per cent were of the four major types mentioned above.

The greatest problem in first-aid treatment of eye injuries is that of preventing infection. Bacteria are carried on oil, grease, sand and dirt and sometimes even the atmosphere itself. Any wound received in a factory may become infected if it fails to receive prompt and efficient first aid.

Of all injuries occurring to the eye, chemical burns rank first, from the point of importance of immediate treatment or first aid.

In areas of the plant where such accidents are prone to occur, the foreman or leader should be instructed to give immediate first aid before sending the worker to the medical department. This should consist of thorough irrigation of the eye with copious quantities of clean running water. The patient is then sent to the medical department. I am purposely leaving out any further discussion of the first aid treatment or subsequent treatment of chemical burns to the eye. Dr. Carlyle has had extensive experience in this field and will discuss this subject more intelligently than I could hope to do.

With the one exception noted above, first aid at the scene of an accident by fellow employees is forbidden. Almost any other type of eye injury is best sent directly to the plant medical department.

Thermal burns are met with less frequently and are generally less serious than chemical burns. These are usually treated by boric acid irrigation folllowed by the instillation of a bland oil. We frequently use ophthalmic butesin picrate ointment or metycaine and merthiolate ointment.

Lead and solder burns are usually less severe than those caused by molten metals with a higher melting point. The impact of the heated metal may inflict damage which is more serious than the burn. Irregular or jagged particles are likely to traumatize the eye more extensively than smooth, even surfaces. Because of the heated object, thermal burns are usually aseptic. Strict precaution must be observed to maintain this status.

Another type of injury is frequently produced by electric sparks, reflected light rays or welding flames. Here the lesion at first resembles an ordinary burn of the conjunctiva, with the resultant edema and redness. Later effects of these injuries may be cataractous lens changes, corneal scars and even occasionally damage to the retina.

The most common eye injury which we see is the foreign body. These may be divided into two groups—superficial and penetrating. In the first instance, the nurse washes the eye gently with boric acid solution. If this does not remove the offending agent, she will attempt removal with a cotton applicator dipped in boric acid. In the event that this is not successful, the case is referred to the plant physician. An excessive amount of poking or the use of a spud by an

unskilled person is dangerous practice and should be generally condemned.

In the event that the case is referred to the physician, a local anesthetic is usually necessary. We use a 2 per cent Butyn solution and wait about five minutes after it has been instilled before any attempts are made at removal. The patient should be reclining and the physician seated at the head of the examining table with the elbows resting on the table. There is less likelihood of sudden motion or slipping, causing more extensive damage. A good light properly focused, clean hands and sterile instruments are of course all essentials. Occasionally 2 per cent sodium flouriscin solution is used for staining purposes.

After removal, a drop of any of several mild antiseptics is applied, followed later by an ophthalmic ointment and an eye patch. It is important to remember that the worker, who has had a local anesthetic used in his eye, should not be allowed to return to his machine without an eye patch. The patch and periodic application of the ointment is continued until the cornea is healed.

Penetrating foreign bodies, which cannot be removed with reasonable ease, are treated by application of an aqueous local anesthetic, eye patch and bandage and the case referred to a hospital for care by a competent eye specialist. The same routine holds for corneal lacerations and punctures.

We experience seasonable and unpredictable waves of simple conjunctivitis. When there is evidence of purulent discharge, we routinely ask these employees to remain home from work for 3 to 5 days and take active treatment under the care of their own eye physician. There is every reason to believe that such cases are readily communicable and the final effect on production is better where they are isolated from their fellow workers. Simple non-purulent conjunctivitis which is mild in character is treated by irrigations, compresses and mild antiseptics. We often use a combination of zinc sulphate and adrenalin on such cases, with good results.

With the advent of fluorescent lighting, there have been numerous complaints regarding the effect on the eyes. We have no evidence that there is any appreciable or harmful ultra-violet radiation from such equipment. The individuals who feel that they must

wear tinted lenses or have other special considerations are fortunately in the minority.

In summary, I would like to emphasize the need for prompt and skillful management of industrial eye accidents. Certainly such a program made available to all workers in both large and small plants will serve to reduce the tremendous number of eye casualties which are experienced each year. Spreading the gospel of proper first aid for the eyes will unquestionably produce dividends.

I am sure that we are all agreed that the most sound approach to this problem is through eye protection. Most eye accidents are preventable. It would seem logical that our best efforts be directed toward this measure.

The broad field of vision in industry is just beginning to open up. It offers great opportunity to those who will take an active interest and study the special problems which it presents. Perhaps the maintenance of visual fitness and job placement according to visual skills may contribute greatly in the reduction in unnecessary accidents of all kinds. The very fact that you are enrolled in this seminar course indicates that you are aware of this challenge. I sincerely believe that the next decade will produce results in this particular field which may well prove an inspiration to industrial medicine in general.

Note and Comment

Progress in WPB Drive to Improve Visual Conditions in War Plants.—The War Production Board's drive to speed up production through improvement of visual conditions in the war industries has made substantial progress in the three months that it has been under way. To date 7,500 plants have received copies of the *Manual and Appraisal Form on Conservation and Utilization of Eyesight in Industry*, and many have availed themselves of an offer of assistance on problems relating to visual production and safety.

This is a program of the War Production Board, the U. S. Public Health Service, the War Manpower Commission, and the U. S. Department of Labor, Division of Labor Standards, in which the National Society for the Prevention of Blindness is co-operating. Advisory service to the war plants on special eyesight problems and the preparation of informational bulletins are being handled in the Society's offices under the direction of its industrial department.

Evidence of the great need for making such information available is found in an analysis of the first 150 appraisal forms voluntarily returned by plants to the War Production Board. Only 61 per cent of these 150 war industries make the pre-placement vision tests necessary to fit the worker to his job. More than three quarters of the plants where such tests are made fail to have the testing done under the direction of an eye specialist, indicating lack of uniformity and possible inaccuracy.

Other facts revealed in the appraisals include: (1) more than 85 per cent of the plants fail to recheck vision of all employees periodically; (2) more than 80 per cent make no recheck of vision of workers exposed to special hazards; (3) 92 per cent fail to recheck vision of employees with poor production records; (4) 83 per cent do not recheck vision of workers involved in accidents; and (5) 73 per cent make no rechecks where original vision tests disclosed need for follow-up.

Although it is estimated that a worker's personal reading glasses are unsuitable for the job in 19 cases out of 20, of the plants

reporting, 58 per cent indicate that they use the employee's personal reading prescription for work glasses. Only 8 per cent have prescriptions for work glasses written in the plant by a company examiner, although knowledge of job conditions is essential in determining such prescriptions.

Only 49 per cent of the 150 plants making the self-appraisal, maintain illumination to conform to *American Recommended Practice of Industrial Lighting*; 35 per cent say that they do not know whether illumination is up to standard.

Five informational bulletins now available in connection with this WPB program are: *Prescription Lenses for the Job; Screening Tests for Job Vision; Production Gains Through Better Industrial Vision; The Nurse's Part in the Industrial Eyesight Program;* and *Nursing Procedures for Eye Emergencies in Industry*. Single copies of any of these may be had without charge by addressing a request to Dr. Donald B. Keyes, Director, Office of Production Research and Development, War Production Board, Washington 25, D. C.

New Film on Glaucoma.—The National Society for the Prevention of Blindness is planning the production of a new film on the subject of glaucoma, for release sometime in 1945. The film will be a one-reel sound motion picture, for use especially with prevention of blindness workers, nurses, social workers, clinics, glaucoma patients, and the families of glaucoma patients. Readers will have an opportunity to learn further developments on the preparation of the film, through future announcements in the REVIEW.

Social Hygiene Day, February 7, 1945.—Despite wartime restrictions in travel, Social Hygiene Day plans are being carried out through local meetings. The relation of the observance of Social Hygiene Day to prevention of blindness was pointed out by Mrs. Eleanor Brown Merrill, Executive Director of the National Society for the Prevention of Blindness, in a statement urging wide observance of that day on February 7. She said, in part:

> "This annual event helps greatly to arouse public interest and support for the broad objectives of the social hygiene program, and such an educational campaign is of indirect help in the effort to prevent blindness and conserve vision. Syphilis and gonorrhea are among the major destroyers of

sight, being responsible for the blindness of more than 30,000 men, women and children in this country.

"At this time, when there is such a critical shortage of manpower in our war industries and essential civilian occupations, the fight to control syphilis and gonorrhea is more important than ever before. To keep America strong we must take advantage of the scientific advances that can help us control these diseases and safeguard eyesight."

Institute on Vision Conservation.—The National Society for the Prevention of Blindness announces that Miss Eleanor W. Mumford, R.N., Associate for Nursing Activities, is to have charge of a three-weeks Institute on Vision Conservation on the Los Angeles campus of the University of California. With the collaboration of the Society, this Institute will be given as a part of the 1945 Summer Session of the University, open to public health nurses, industrial nurses, and teachers interested in special study in this area, and will carry three units of University credit toward special education teaching credentials and elective credit in the public health nursing curriculum.

The services of Dr. W. Morton Gardner, an ophthalmologist long prominent in the school eye health program of Los Angeles, have been obtained by the University to present the scientific basis for Principles of Vision Conservation. Miss Mumford will give the practical application of these principles and teach techniques in Vision Conservation. Further information on the course can be obtained by writing to Dr. J. Harold Williams, Director of Summer Sessions, University of California, 405 Hilgard Avenue, Los Angeles 24, California.

Current Articles of Interest

Industrial Injuries of the Eye, Elbert S. Sherman, M.D., *Archives of Ophthalmology*, July, 1944, published monthly by the American Medical Association, 535 N. Dearborn Street, Chicago 10.

Dr. Sherman, who has practiced for many years in the center of a large industrial district, advises ophthalmologists concerning features of compensation, an element in industrial practice which is not popular with some ophthalmologists because of the necessity for elaborate reports and because of the importance of evaluating the extent of final vision loss, which is often difficult to evaluate without observation over a period of time. Dr. Sherman stresses that reports should be prepared to be read by the layman, and at the same time very definite information must be given.

Penicillin in Ophthalmology, J. G. Milner, F.R.C.S., Squadron Leader, R.A.F.V.R., *British Medical Journal*, August 5, 1944, published weekly by British Medical Association, Tavistock Square, London, W.C.

On the basis of 144 Service cases, handled within three months, Milner reports that penicillin drops (500 units per c.cm.) appeared to retain potency for four hours, ointment (100 units per gramme) for six hours. Good results were obtained in blepharitis, acute conjunctivitis, and corneal ulcers (infective); it is also apparently effective in chronic dacryocystitis, recurrent styes and infected cholazion. Indications for its use are: (1) very serious injury to the eye, whether penetrating or not; (2) any facial burn involving the eye; (3) routine post-operative treatment. Conditions in which penicillin appears of doubtful or no value include chronic conjunctivitis, episcleritis, trachoma, phylctenular keratitis, marginal ulceration, herpetic keratitis, etc. Yet even in these cases, where a secondary, penicillin-sensitive organism is also present, healing may be indirectly abetted by the administration of the drug.

A Quantitative Test for Measuring Degree of Red-Green Color Deficiency, Louise L. Sloan, Ph.D., *American Journal of Ophthal-*

mology, September, 1944, published monthly by the Ophthalmic Publishing Company, 837 Carew Tower, Cincinnati.

The Color-Threshold Tester, which is designed to measure ability to distinguish colored lights of low intensity and subtending small visual angles, is described in its physical aspects, conditions and procedure of administration, and method of scoring. To determine the validity of the Tester, 100 subjects were given also five other color-vision tests. Scores were arranged into intervals containing approximately the same number of individuals, and a high correlation with each of the other five types was evident. The conclusion of the author is that persons with marked inability to distinguish colored lights of low intensity will *probably* also show poor ability in other tasks requiring color discrimination, but recommends that the color-vision test chosen for the selection of aircrew personnel should be that which correlates most closely with practical field tests related to their special tasks.

Trachoma in London: The End of a Chapter, Arnold Sorsby, M.D., F.R.C.S., *British Medical Journal*, August 12, 1944, published weekly by the British Medical Association, Tavistock Square, London, W.C.

On May 10, 1944, the trachoma block at White Oak Hospital, Swanley, was closed, symbolizing the end of trachoma's epidemic existence among London's children, which has existed since the first half of the last century, when it spread among the children under the care of the Poor Law authorities. Observance of rigid isolation quickly met the situation, and has proven that making trachoma a reportable disease and enforcing isolation will be the way to cope with the incidence among the adult population.

Prophylactic Value of Sulfathiazole Against Neonatal Gonococcic Conjunctivitis, Morris Gleich, M.D., Marvin L. Blumberg, M.D. and Alvin S. Mason, Jr., M.D., *American Journal of Diseases of Children*, June, 1944, published monthly by the American Medical Association, 535 N. Dearborn Street, Chicago 10.

Since incidence of ophthalmia neonatorum continues despite silver nitrate requirements in 46 States, a thirteen-month study was conducted at Harlem Hospital, New York City. Results

showed that oral administration of sulfathiazole in a total dose of 20 grains in three days, starting 12 hours after birth, is effective. It is suggested that this drug dosage be administered routinely as an adjunct to the instillation of silver nitrate.

1. Epidemic Keratoconjunctivitis, Robert F. Korns, M.D., Dr.P.H., F.A.P.H.A., Major M. Sanders, M.C., A.U.S. and R. C. Alexander, *American Journal of Public Health*, June, 1944, published monthly by the American Public Health Association, 1790 Broadway, New York 19.

2. Epidemic Keratoconjunctivitis—Detroit Experience, Joseph G. Molner, M.D., F.A.P.H.A. and E. L. Cooper, M.D., in *ibid.*

The first article presents evidence, from sera of epidemic keratoconjunctivitis cases and their contacts, supporting the opinion that the virus isolated by Sanders is etiologically related to the disease. The second suggests two steps in controlling the disease: (a) making it reportable; (b) inaugurating communicable disease technique in the eye clinics of industrial plants. It also relates the apparent therapeutic value of tyrothricin, as evidenced in a study of Detroit cases.

Physical Impairments in Low-Income Farm Families, Mary Gower and Jesse B. Yaukey, *Public Health Reports*, September 8, 1944, published weekly by the U. S. Public Health Service.

During the past nine years the Farm Security Administration has been engaged in rehabilitation of low-income farmers with insufficient collateral to borrow from banks. It was found that successful rehabilitation necessitated attention also to their health and physical condition. Data for the present report was gathered during 1939–40, from 19 counties over the country, whose population consisted mainly of native whites and Negroes.

Summary of findings of vision defects by the authors reads: "Curves of the age prevalence of defective vision as determined by the Snellen test are presented for this group and compared with other available data. The relative age prevalence of defective vision among rural rehabilitation farmers agrees with that of farmers examined by the Life Extension Institute, and differs from that of urban groups examined, in a less rapid rate of increase in

young adult ages and a more rapid rate of increase between 40 and 50 years of age. With respect to the actual value of recorded prevalence rates, the F.S.A. borrower families have less defective vision as determined by the Snellen test than available examined urban groups especially between the ages of 20 and 45 years; they also compare somewhat favorably with another examined agricultural group, but it is impossible to say how much of this difference might be due to differences in group selection and examining procedure.

"Sex and color comparisons show that females have a higher percentage of defective vision than males for every age group; Negroes in these data have less defective vision than whites for all age groups."

Book Reviews

CLAREMONT COLLEGES READING CONFERENCE, NINTH YEARBOOK 1944. Claremont, Calif.: Claremont Colleges Library. 168 p.

Anyone interested in the teaching of reading, who has not been convinced that reading difficulties can seldom be traced to one simple cause, will find much food for thought in the Ninth Yearbook of the Claremont Colleges Reading Conference. This Conference aims to give consideration to a much broader concept of the nature of the reading process than is found in programs treating only a limited portion of the field.

Naturally, the Report re-emphasizes the fact that a careful study must be made of the learner's physical condition, his intellectual capabilities, his social and emotional nature, and also of the influences from without that may affect his development. The contributors reiterate that although intelligence is perhaps the major factor in school success "the physical machine should be put into running order as a prerequisite for satisfactory adjustment of that machine." Therefore they devote much discussion to the possible effects on the reading program, of visual, auditory and speech difficulties.

One contributor brings out the fact that although seeing is a native ability, efficient seeing must be learned. Since visual education means a full development of visual abilities, consideration must be given, among other aspects, to the relationship between binocular co-ordination and school success, and the effectiveness of orthoptic training when reading difficulties indicate a need for such.

Other contributors recommend that visual speech reading supplement aural speech reading, for those who have suffered aural impairment, and indicate the value of the use of auditory stimulation in the speech program.

The discussion of nutrition in its relation to school success points to the often-forgotten part that food plays in providing the energy required for reading, in whatever form it takes.

The Report has emphasized the fact that much remedial reading

might be avoided if expert service is given in laying the foundation of a reading program, through intensive study not only of the learner but of the tools with which both teacher and pupil must work.

Recognition of the competition of the school program with comics, radio presentations, etc., leads to suggestions for the better programs and materials for pupils of all ages by capitalizing on their individual interests, by developing audio-visual education as a possible substitution for programs centered exclusively upon printed textbooks.

The part that language plays in international relationships is exceedingly timely, and naturally leads to the desirability of teaching students to read and to speak foreign languages. One contributor suggests that since "we are usually down on the things we are not up on," the ability to converse freely and with facility is a basic preventive for misunderstanding.

The breadth of material offered in this Conference is indicated by the list of those who contributed papers. This includes not only those whose interest in the subject is taken for granted—school administrators, college professors, teachers, psychologists, parents, librarians and publishers—but a director of the Urban League, a representative of the National Safety Council, and a lieutenant of the U. S. Navy, whose excellent contribution, "Reading Problems of Technical Training in the Navy Air Force," brought to the Conference the significance of the problems facing those who prepare men and women for war work.

Fortunate indeed are those who could attend this Conference, for those who could not, the well-presented report of the proceedings serves not only as a recompense, but as an example of what the Conference itself demonstrated: the importance of the ability to read.

—Winifred Hathaway

Building a Popular Movement: A Case Study of the Public Relations of the Boy Scouts of America. Harold P. Levy, Department of Social Work Interpretation, Russell Sage Foundation, New York, N.Y. 1944. 165 p.

This analysis of the efforts of the Boy Scouts organization to create and maintain popular understanding and good will should

be of interest to all who are engaged in public relations activities. In addition to promoting Boy Scout sequences in commercial movies, both dramatic and newsreel, the Scouts have built up their own library of non-commercial motion pictures for sale or rent to local councils; they are also carrying on an extensive program of broadcasting, newspaper publicity and exhibits.

Mr. Levy is Research Associate in the Russell Sage Foundation's Department of Social Work Interpretation, directed by Mrs. Mary Swain Routzahn. In an introduction, Mrs. Routzahn comments: "Public relations work is widely accepted as an essential accompaniment to any public service. So far, however, many agencies are unable or reluctant to seek funds to provide for necessary staffs and materials."

—David Resnick

Briefer Comment

Rehabilitation of the War Injured. William Brown Doherty, M.D. and Dagobert D. Runes, M.D., Eds. New York: Philosophical Library, 1943. 684 p.

This symposium on medical and psychological treatment of war casualties contains two chapters on eye injuries: "Rehabilitation in Non-recoverable Eye Cases," and "Rehabilitation in Ophthalmic Cases." The former recommends rehabilitation in a blind environment, as producing a more encouraging mental state; where neither too much, nor too little, is done for the patient. The philosophy and chronology of treatment at St. Dunstan's, where the author of this chapter (R. C. Davenport, F.R.C.S.) is Medical Officer, is outlined. The latter chapter, by Lady Duke-Elder, outlines rehabilitation of recoverable cases involving the loss of one eye or occurrence of acute muscular imbalance, and of patients convalescing from an ocular disease or injury. Also included are two chapters on the legal aspects of rehabilitation and compensation.

Contributors to This Issue

Walter B. Lancaster, M.D., a practicing ophthalmologist of Boston, and member of the Society's Board of Directors, was the 1943 recipient of the Leslie Dana Gold Medal.

Jack Masur, M.D., is Acting Chief Medical Officer, Physical Rehabilitation Section of the Office of Vocational Rehabilitation, Federal Security Agency.

Adolph L. Posner, M.D., is now serving as Captain in the Medical Corps, Army of the United States.

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Philip Drinker, Sc.D., is Chief Health Consultant, U. S. Maritime Commission, Washington, D. C.

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Book Reviewers: **Winifred Hathaway** is the Society's associate director, and author, most recently, of the much-used volume, *Education and Health of the Partially Seeing Child;* **David Resnick** is director of public relations for the Society, and also serves as public relations counselor for a number of other public health and welfare agencies.

The Sight-Saving Review

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Sight Conservation*

Eleanor Brown Merrill

AUTHOR presents the history, activities, and co-operative aspects of the national program for prevention of blindness and saving sight.

THE prevalence of blindness in the United States is not completely disclosed by census data nor by other studies. The best estimates available, however, place the figure for the number of blind at somewhere between 200,000 and 250,000. Undoubtedly, the number of persons with seriously defective vision who are not blind is larger, and moderate or slight degrees of deviation from normal vision are quite common in the population at all ages and at all economic levels. Estimates of their prevalence by type and by degree cannot be made with any accuracy at the present time; experts find it difficult to define a "defect" in as much as the need for correction depends largely upon the individual's tolerance or ability to adjust to a minor visual difficulty.

The beginning of an organized campaign for prevention of blindness may be traced to a report made in 1907 by a special commission[1] appointed by the governor of New York State to investigate the condition of the blind. Coming to the attention of certain public-spirited men and women, this report led to the formation in 1908, under the auspices of the Russell Sage Foundation, of a New York State Committee for the Prevention of Blindness, forerunner of a national committee the name of which later was changed to National Society for the Prevention of Blindness. The New York State Committee, functioning for a while as a standing committee of the national body, was later discontinued with

* Reprinted by permission of the Russell Sage Foundation from Social Work Year Book 1945.

[1] Under the chairmanship of Dr. Park Lewis of Buffalo.

recognition that preventive activities had been incorporated as a definite responsibility of the New York State Commission for the Blind.

Simultaneously, the formation of other state programs in the field of sight conservation proceeded haltingly and under varying auspices. Voluntary societies soon came into being in Illinois, Kentucky, and Maryland. At the same time there was a steadily increasing trend for such services to be centered under governmental departments. The latest count (as of July, 1944) shows one regional and six voluntary state[1] societies for the prevention of blindness and 18 official state programs, the latter group functioning through the administrative set-up of the state department of welfare or social security, health, or education, or as an independent state unit. Each of these societies and state programs is operating independently of the National Society for the Prevention of Blindness which has no branches but serves as a liaison agency, with a promotional and educational program dealing with every known aspect of sight conservation.

In addition to the above-mentioned agencies, 20 state medical societies have appointed conservation of vision committees, and privately supported programs for prevention of blindness are functioning in 22 local communities.

Of primary concern in the movement to prevent blindness is the infiltration of adequate eye health and safety practices into appropriate existing agencies. Immediate objectives in 1908 were the securing of measures to prevent ophthalmia neonatorum, or "babies' sore eyes," a disease then responsible for the blindness of approximately 28 per cent of the children in schools for the blind. In the latter part of the nineteenth century it had been established that by the use of silver nitrate drops in the eyes of infants at birth ophthalmia neonatorum could be prevented; yet it took several decades before this simple preventive measure was put into practice on any widespread scale. While still a matter of concern, prevention of blindness from ophthalmia neonatorum receives less promotional emphasis today, since the public—lay and professional—has become aware of the menace and of preventive possibilities. All but two states now have some type of law or health department

[1] Including the District of Columbia.

regulation requiring the use of a prophylactic in the eyes of the new-born.

Concurrent with progress in this aspect of the prevention program, activities were extended in other directions. "Sight-saving classes," first established in Boston and Cleveland in 1913, have now become an important part of the field of special education, thanks to the promotion, stimulation, and constant pressure of the prevention of blindness movement. Under administration of the educational authorities, these classes for children with seriously defective vision were operating in 1944 in the public schools of 220 communities in 31 states, the District of Columbia, and the Territory of Hawaii, with a total enrollment of approximately 8,500 boys and girls. Through them the needs of the partially seeing are being met with specially designed equipment and methods of instruction. Teachers for these students are prepared in university courses offering graduate credit, which are sponsored and conducted by leaders in the prevention field. Since it is estimated that two out of every 1,000 of the school population may be classified as partially seeing and thus in need of special educational facilities, it is evident that the present number of these classes is far from sufficient. Nor can it be said that properly qualified teachers are used everywhere. However, the foundations are soundly laid, with indication that departments of education will eventually accept their responsibility for the special education of all partially seeing children. The future should bring an expansion of services now hindered by lack of funds and personnel.

An indirect accomplishment of the special classes is the influence they have had upon the standards of illumination, equipment, and health practices throughout educational systems. For many of the nation's school children, eye protection is afforded through periodic vision tests, provision of adequate light and other hygienic surroundings, and ministrations of the school doctor, nurse, and well-prepared teacher. In a few cities school ophthalmologists have been appointed to serve full or part time in order to insure complete and early attention for eye difficulties among the pupils. But ideal conditions are by no means universal or even common; and to a great extent conservation of vision efforts are directed toward the further development of programs for discovering visual defects among

children of school and preschool age. Screening or case-finding methods were introduced some years ago and are still under study. While not widely used for preschool children, they form the basis for most of the testing in schools, having been widely incorporated in standard literature and manuals on school health work.

Likewise, standards and practices recommended with a view to prevention of blindness have been incorporated in literature of the National League of Nursing Education and the National Organization for Public Health Nursing, and emphasis is being put on the importance of eye health teaching in basic education of nurses, especially those engaged in or being prepared for the public health field. Need is seen for accentuated efforts along similar lines with relation to teacher education, as well as in connection with other branches of professional training.

Since 1907, when a social service department was first established at Massachusetts Eye and Ear Infirmary, Boston, there has been increasing recognition of the sight-saving potentialities of a program in which ophthalmological treatment of eye conditions is supplemented by the service of a medical social worker who can establish the desirable patient-clinic relationship, adjust complicating factors, and help to assure best results from the medical or surgical care. *See* MEDICAL SOCIAL WORK. Such service emphasizes the necessity of regular attendance for certain conditions which require continued treatment to prevent greater impairment and possible loss of vision. Massachusetts Eye and Ear Infirmary was first used as a training center for a small group of workers to be stationed in other medical social service departments. This phase of prevention of blindness activity was given impetus through demonstrations in a few strategically placed medical centers from which have radiated the principles and concepts which have served to point the way to present practice. A project at Washington University Hospitals and Allied Clinics, St. Louis, led to selection of that University's Department of Social Work as a training base; and in ensuing years courses have been given as the need arose and as persons qualified for postgraduate work could be located.

Recent growth in state prevention of blindness activities has created a demand for qualified persons to administer these programs. With recognition of the medical social worker's value in the

hospital set-up has come the wish for her service in the more generalized area outside the hospital walls. Consequently, plans for continuing and broadening the training content are under consideration. A principal objective of the prevention of blindness movement—that of having qualified leadership in the various organized programs—is halted only because of the difficulty during this war period of securing personnel for training.

Steps are being taken in a number of ophthalmological clinics to secure regular attendance of patients with glaucoma—an eye disease which, according to present scientific knowledge, is not subject to cure, although control measures are commonly known by the ophthalmological profession. Prevention of blindness workers, both nationally and locally, are taking an increasing part in efforts to secure early detection of the disease and in helping to develop standards of clinic management, recording, and so forth. Volunteer assistance for certain technical details of examination following periods of essential training is being encouraged.

Indirectly, other services within the hospital group make definite contributions. Through treatment of syphilis, tuberculosis, and nutritional and other disorders, visual disturbances may be discovered in their incipient stages. Conversely, general systemic conditions are frequently detected through careful eye examination. The eye worker's relationship to other specialists within the medical team is a far-reaching one.

Outside of the medical institution and closely linked with prevention of blindness are those public health programs aimed at prevention of diseases which are often the incidental cause of visual loss. For example, progress in social hygiene—through public education and through legislation requiring premarital health examinations and Wassermann tests for expectant mothers—contributes indirectly to the saving of eyesight. Treatment in pregnancy of the syphilitic mother reduces to a minimum the danger of transmitting to the unborn child a disease which in former years has been responsible for a large percentage of blindness among the youth of the country. *See* SOCIAL HYGIENE.

Steps were first taken some years ago to reduce the amount of blindness from industrial accidents. Periodic studies have been made and educational material published in attempts to bring

about safer practices. Certain industrial concerns demonstrated conclusively that the mandatory use of goggles and other protective devices in hazardous occupations kept eye injuries to a minimum; yet in spite of efforts on the part of safety organizations and personnel the adoption of precautionary measures was largely disregarded.

With the tremendous expansion of industries engaged in war production—all operating under heavy pressure and to a large extent employing inexperienced workers—danger to eyesight has in the past few years become appreciably greater. New agencies have been created and existing programs given fresh impetus to deal with this problem. The United States Department of Labor has undertaken an eye safety campaign under its National Committee for Conservation of Manpower in War Industries; the National Safety Council and its local affiliates have redoubled their efforts; and prevention of blindness agencies have put increased emphasis on industrial education. Although there is now fairly widespread practice of general safety measures in factories and plants of all kinds, there is still inadequate provision for protecting eyesight and improving visual efficiency, as disclosed by a recent sampling of typical first-rank industrial organizations. Still less has industry on the whole adopted adequate eye health procedures, which must include pre-employment and periodic eye examinations, job analysis with a view to special placements, prescription lenses in goggles as needed for safety or efficiency, and other hygienic measures important in sight conservation. The United States Public Health Service through its Division of Industrial Hygiene is concentrating on this problem and participating in a broad co-operative project through assignment of an industrial ophthalmologist to the National Society for the Prevention of Blindness for special field work and studies. Others taking active part on the national level are the War Production Board, the Joint Committee on Industrial Ophthalmology of the American Medical Association and the American Academy of Ophthalmology and Otolaryngology, and the nursing profession, the last-named extending its industrial nursing service and developing special skills in relation to eye care. Local action in this area is being promoted largely through state health agencies, prevention of blindness organizations, and through labor-management committees in industry.

As may be seen, the prevention of blindness is essentially a public health movement, reaching out into many avenues of organized society. On the national level it is intimately associated with the National Health Council and its affiliated agencies. Here, as well as on the state level, it functions through or in relationship to welfare and educational channels of various types, and in close cooperation with the medical profession—on whose scientific knowledge the whole program of teaching and demonstration is based. Certain aspects of the effort to prevent loss of sight are closely related to work for the blind: for example, study of causes of blindness; study of eye conditions and problems of sighted children in schools for the blind; and restoration of sight and other activities growing out of state services on behalf of the needy blind. But the fundamental concept of prevention of blindness endeavor is to keep eyes healthy and save individuals from becoming needlessly handicapped by partial or total visual loss. It is the building of protective barriers, rather than the development of ameliorative and other social measures for a particular group.

Workers in this field are faced not so much with new problems as with the accentuation of old problems arising from the present world conflict. Rehabilitation of men released from military service and from industry who are suffering from visual handicaps is of immediate concern and will become more pressing in coming months. Increase of venereal disease with its eye complications calls for intensified efforts in this direction. A rising toll of industrial accidents will continue unless drastic steps are taken to fight this costly trend. The spread of various eye infections with return of our military and civilian forces from the battle areas is another danger. Injuries resulting from the war may draw heavily upon the resources of official and voluntary agencies; and a decrease in the number of available eye physicians and other personnel is a further threat to sight conservation.

On the other hand, science is equipped as never before to meet current demands. An ever-broadening participation in the program gives opportunity for strengthened and united efforts, and years of experience have blazed paths that will show the way for new accomplishment.

Patron Saints of the Eyes: An Outline*

Ferdinand L. P. Koch, M.D.

PRESENTS the lore of outstanding saints in the Middle Ages who were canonized for their performance of miracles in saving eyesight.

HEALING through saints in early and medieval Christian centuries transcended that by physicians, who were secondary and enjoyed only scant encouragement when saintly personages could be invoked to cure. Man, animals, and the heavens were set by custom in fixed categories: Man was above the beasts but below the angels; he was foreordained to worship God but all else had been created to serve man. Dissenters forfeited their rights and privileges and were punished publicly. The Christian martyrs, many of whom became saints, were among these because their professed beliefs differed from those of others in the community.

Lacking the solace of scientific reason, refuge was sought in superficial explanations of terrors of nature. These developed as narratives that increasingly were employed to diminish the unreasoning fear engendered by abnormal activity of the elements. Thus, naturalistic legends ensued, while supernatural legends evolved as stories of the saints.

Miracles

A great variety of miracles has been reported in some detail, but Brewer questions whether all of those vouched for by the Fathers during the first three centuries of the Christian era should

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be accepted, since by far the great majority of all recorded miracles occurred during that single period of time. Sight has been reported to have been restored to persons of all ages and to both sexes, and to those who were born blind as well as to those who had become sightless. Miraculous cures most often, apparently, were achieved by the laying on of hands, the making of the sign of the cross, by prayers or by other words, by an attitude of gaze, by bathing the eyes in water used by the healing one, or by a combination of two or more of these methods. The recipients of the return of vision are anonymous in the main or are identifiable only briefly. Very rarely supernatural powers were invoked to effect blindness in an offender.

Popular faith in miracles, particularly in times of illness, evolved from the intimacy of suffering attendant on the close relationship of the sick and the saints. However, as Pettigrew observed, in part, ". . . all miraculous cures are of the same description, the disorders are similar, and the effects described are precisely the same. It is faith which works the miracle. . . ." But Le Bec, staunch in his belief that there must be recognized the existence of "a mysterious force emanating from the Holy Eucharist," stated: "Miracles are not made to order."

Miracles in the Christian legends, which are as venerable as Christianity itself, instanced the intervention of God in such fashion that intangibles assumed reality: The impious suffered righteous punishments and the devout were rewarded and their prayers were heard. The early Western Church only secondarily and with reluctance supported this faith in miracles and in saints, but its blessing permitted the glorification of the miraculous in ecclesiastical art and indirectly was largely responsible for the biographic portrayal of the saints as we know them at present.

Saints

The term saint, (from the latin, *sancti*, and the Greek, *hagioi*) refers to members of a Christian community but is applied particularly to those who lived in Jerusalem (Dan vii. 18 sqq., et cetera). The deeds and lives of some individuals indicated exceptional possession of piety and spiritual grace, and this character

was attributed in natural course especially to those who had suffered martyrdom. This first was expressed in the letter of the Smyrna congregation. Communities kept registers of those Christians worthy of public veneration, and this was permissible only by order or authority of the bishop. These names were recited at the Eucharist. Hutton states: "From these diptychs (lists) came the kalendars, and from the kalendars in later days the martyrologies." And it is from the latter that the legendaries developed.

Christian martyrolatry replaced pagan worship of the dead, but modified pagan *parentalia* became birthday feasts and festivals of the martyrs. Thus, paradoxically, veneration of the saints permitted expression in part, at least, of the basic heathenism which the Church had supplanted. Prayers for saints at eucharistic oblations were transformed into intercessory appeals. Every altar had its relics, and chapels of saints received the sick as once did the temples of Aesculapius. Amulets became a part of the dress, and no important undertaking, personal or communal, was initiated without invoking the aid of appropriate saints. Success usually necessitated a formal expression of gratitude, and recovery from illness after saintly intercession caused the presentation of medical votive offerings to churches, chapels, or altars.

Hagiography.—The *depositio martyrum* in the calendar of the Roman chronographer (354 A.D.) is the oldest known calendar, or almanac, dealing with the lives of the saints; however, only the barest biographical facts are recorded and, since these did not satiate the faithful, there developed the hagiographic legend as a literary device to cater to numerous local preferences and mores. These legends entertained, as they instructed edifyingly in religion and morals but, prior to the thirteenth century, they had been collected only in liturgical manuscripts and differed little from those written from the fourth to the sixth centuries. These Christian legends served originally to epitomize asceticism and martyrdom and to create an apochryphal history of the apostles from the stories of their lives in the Gospel; known facts of genuine martyrologic instances embellished incredible tales for the credulous, and central figures were so interpreted as to leave no doubt of the virtues and joys implicit in the practice of Christian principles. Not infrequently, however, the only historically demonstrable

facts in a particular legend are the name of the saint, the fact of canonization, and the date of the festival in question.

The foremost hagiographer, Jacobo da Voragine, the Archbishop of Genoa, portrayed the lives of the saints in his "Legenda aurea." His stories were not new but were arranged in order as in the several calendaria. He constantly moralized under the text of august example, and he was a diligent, uncritical recorder of tradition. As an educator he made available to the many the lore which, in his day, was largely the property of the few with access to monastic lectionaries. His stories were comprehensible to all because of their direct, even coarse, pliant style. Reference so often was made to current moods and beliefs that the work appealed widely to a sorely tried but indefatigably optimistic age. It became the most popular work of the Middle Ages and exerted considerable influence on the arts. It had none of the appearance of the work of an individual; its tone was more that of the accumulated folklore of all Christendom. It provided the average Christian with an escape from the narrow geographic boundaries and the restricted social barriers of his daily existence. And equality of mankind gained a partisan whenever it was learned that the wealthy and the poor knelt as equal supplicants.

Intercessory Specialization.—Appeals to formerly unknown saints for assistance against certain maladies resulted increasingly in specialization. This refinement is an extension of a constant tendency since earliest antiquity to request special protection for particular bodily parts. Saints as patrons of specific diseases generally were chosen as such because of some appropriate miracle thought to have been performed during the life of that saint, or in some specific detail of martyrdom, or in a peculiarly tonal association of the name with that of the part or of the morbid condition. This association of names, so current among the more humble of the populace, was not to be found in the almost inaccessible, obscurely written, liturgical manuscripts, and it was not until the thirteenth century that Jacobus first integrated them into his "Golden legend." Ecclesiastical art visually portrayed the saints thus popularized and aids in interpretation not only of the supernatural legend with reference to ophthalmology but also, of the associated artistic masterpieces.

Saint Lucy

Those suffering primarily with external diseases of the eyes invoke the aid of Saint Lucy (Lucia), a virgin and martyr of Syracuse, in Italy (Sicily). Historically, it is known that she was born into the nobility in about 283 A.D., of wealthy Christian parents. Her Italian father's early death left her dependent on her devoted Greek mother, Eutychia (or Eutitia). Lucy, as did many other early martyrs, desired to consecrate her chastity to God and worked constantly to devote her anticipated material wealth to the use of the indigent; however, her mother, who held control of the property, did not agree with this noble resolve until after her chronic, intermittent vaginal bleeding had ceased while praying at the shrine of Saint Agatha in Catania where she had been taken by Lucy. Brewer has given the story of this miracle in some detail:

> Lucy prayed to Saint Agatha to intercede for her mother and, while still in prayer, the saint appeared with heavenly angels and said, "Sister Lucy, why ask of me what you can yourself give unto your mother? Make your petition to God, for be assured if He loves me, He no less loves you also. If He will hearken to my prayers, so will He unto thine. If I am honored as a saint here in Catanea, you shall be honored as a saint in Syracuse."

Lucy found her mother restored to health and persuaded her to permit distribution of most of their wealth among the poor; however, the pagan youth to whom she had been unwillingly betrothed objected to this openhandedness and reported her unfavorably as a Christian to Paschasius, the governor of Sicily. She was found guilty and condemned to prostitution but she stood so immovable in the strength of God that even four oxen could not drag her from the spot where she stood. Further tortures and indignities then were forced upon her, but her faith in God still was so unswerving that her death finally was accomplished only when her throat was punctured by a sword. Baring-Gould pointed out: ". . . with Saints . . . when everything else seems ineffectual to hurt them, cold steel breaks the charm."

Saint Lucy's most careful historians mention her blindness as one of her most grievous torments, but there is no documentation

concerning the actual loss of her eyes. Mention of the latter does not occur either in her "Acta" or in any of the earliest legends, but early artists expressed her name, Lucia (*or lux*), by placing an emblem of an eye, or eyes, near her, in their works. Jameson not infrequently encountered such instances "of the convergence of the image or metaphor into a fact," and it is most probable that from such sources there developed the additional supporting incident or incidents in the history of her life.

Jameson also reports that many references exist with regard to the loss of Saint Lucy's eyes. This apocryphal narrative tendency apparently developed several centuries after her historic martyrdom. It is related, for example, that a young man of her acquaintance in Syracuse, although he expressed his deep love for her in every ardent fashion, found it unrequited. Her eyes had so captivated him that he was unable to think of anything else. Lucy felt not only that her vow of chastity was in danger but she also feared for the safety of her suitor and, bearing in mind the dictum of Christ, she plucked out her offending eyes (the method is not given) and sent them to the young man on a salver. He then, worthily enough and in atonement for the deep injury he had initiated, was converted to Christ, and lived thereafter in virtuous chastity. However, it was not ordained that the pure and blessed Lucy should remain sightless; as proof of her courageous piety, her eyes suddenly were restored more pristinely beautiful than before, as she knelt one day in prayer.

Saint Lucy, according to the many works dealing with the lives of the saints, is among the most illustrious of the virgin-martyrs and was so honored at Rome in the sixth century. Her feast day is celebrated annually by Latins and Greeks and by many warm-country Catholic peoples on the thirteenth of December, which also is the festival of Saint Odile. This coincidence has given rise to some confusion. Saint Lucy, in a painting by Albertinelli which hung in the Munich gallery, is recorded in the German catalogue as Saint Ottilia; however, the latter was an abbess and, in all devotional pictures, properly is so represented. The thirteenth of December was a date known throughout the Middle Ages, especially in Western and Central Europe and in the Mediterranean countries, as the night of Saint Lucy, when demons and phantoms

roamed the earth spreading illness. She popularly was believed to spend that night annually dispersing evil spirits and warding off whatever malignancies they were perpetrating. Her feast, even today, is observed nationally in Sweden, a predominantly Lutheran country, when on that date a girl of each family, dressed all in white and wearing a lighted crown of candles, appears at dawn and offers coffee and "Lusia cakes" in honor of the saint who symbolizes the return of the light of day and the bringing of cheer.

Saint Lucy is the principal patron saint of Syracuse as well as of Alife, and she is a minor patroness of Palermo and of Mantua, Italy. She is invoked not only primarily against diseases of the external eyes but against ocular diseases in general as well as the loss of sight. She is believed also to protect against sore throat, epidemic diseases, dysentery, and any type of hemorrhage. The laboring poor, ploughmen, and tillers of the soil venerate her as their patroness. Her festival was celebrated as one of the second rank in England until the Reformation, and no work except tillage was permitted on that day.

Swainson mentions in his "Weather folk-lore" with reference to the thirteenth of December, the day of martyrdom of Saint Lucy:

> "Lucy light, the shortest day and the longest night." Jacobo da Voragine, introducing his chapter on Santa Lucia, says: "Lucia means light. Now the aspect of light is beautiful for by its very nature it contains all classes. Hence we must understand that St. Lucia possessed the ornament of immaculate virginity; that in her was an outpouring of heavenly love without any impure passions. Her prayers went directly to God, and she passed the whole day in charitable works, without pause and without vexation. Or Lucia also means lucis via, a path of light."

Blake writes:

> "There is a manuscript, written in 1220, preserved in the dome of the Milan Cathedral, and cited by Gottofredo of Bussero, stating that Lucy took her name from 'light.' Cardinal Frederick Borromeo, in the sixteenth century, in his book, 'On sacred paintings,' mentioned a connection between Saint Lucy and the pagan divinity Lucini, who was also recommended for ocular troubles."

Artists and sculptors, great poets and writers, and even an explorer, have done homage to Saint Lucy and have added to her renown. Santa Lucia, an island in the Lesser Antilles, was discovered on the thirteenth of December and named by Christopher Columbus in her honor because, it is related, he had been cured of ocular trouble by her intercession; however, de Ybarra does not confirm this, although it is possible that chronic uveitis coexisted with the rheumatism (and not gout) from which Columbus suffered throughout his adult life.

The devout poet, Dante, professed such great devotion for Saint Lucy that he stated in the "Convivio" that he would name one city for Mary and the other for Lucy, if he had a total of only two to name. He wept so copiously over Beatrice that Saint Lucy cured him when his eyes were affected. The light, exhilarative joy aroused by thoughts of Saint Lucy is expressed in the Neapolitan Boat Song, "Santa Lucia."

Many artists have portrayed Saint Lucy in many attitudes, media, and in a variety of styles. Details of her martyrdom; her emblems, the cord and eyes; the lamp symbolic of illuminating grace; the two eyes placed on a dish, a salver or on a missal held in her hand or situated nearby; the poniard, dagger, or sword; and the blessed palm of martyrdom are depicted individually or together in the various paintings, sculptures, glasswork, polyptychs, altar pieces, predellas, and bas-reliefs. The earliest works, as well as those of later centuries, portray her holding a palm as the symbol of her martyred death for the sake of Christianity while the two eyes figure in some fashion more prominently in the later works. She consistently has been endowed in art with the character of celestial light and wisdom. Among those who have thus represented her are Tiepolo (in the Church of the Holy Apostles, Venice), Luca della Robbia (in bas-relief, over the door of the Church of Saint Lucy, Florence), Domenico Veneziano (in an altar piece in the same church), Barroccio, F. Angelico, Luca della Robbia (Church of Santa Maria a Ripa, Empoli, Italy), Carlo Dolce, Giovanni de Spagna, Lello da Velletri, Antonio Riccio, Paramegianino, Bernardino Luini, Antonelle Gaginia, le Perugin, Lodovico Brea, Arcangelo Aquilini, Jacopo Avanzo, Pesellino, Angelico da Fiesole, Benedetto del Ghirlandajo, Niccola Grassi, Pietro Ale-

manno, Crivelli, Garofalo, Bartolo di Fredi Battilore, Lorenzo Costa, Gabriele Capellini, Domenico Ghirlandajo, and Lorenzo di Niccolo Gerrini.

Saint Odile

The recorded biographies of Saint Odile (Ottilia, Odilia, Otilia, Othilia, Obdulia) are considered by Waite to illustrate the growth of a legend, the romance elements of which have been woven about certain other basic facts that appear to him to have been fairly well authenticated historically.

There is in French Alsace a Mount Hohenburg which is said to have been a retreat of Alsatian Celts who protected it by a wall. It became a Roman camp for a time but, in the latter half of the seventh century, Adalric, Duke of Alsace, was in possession of this site on which a castle already had been erected. Adalric (Adalrich, Adalricus, Etic, Ettico, Aticus Etik—*Vatican spelling*), or the Alemannic duke, Eticho I, was an imperious nobleman of his time who owed allegiance to his King, Childeric II, a reputed descendant of Archinould, Duke of Normandy, and a near kinsman of Dagobert the Great. Adalric married Bereshinde (Bereswinda, Berswinde), a relative of Saint Leodégar (Léger). The "Life" of Saint Odile (the "Vita" written in the tenth century), embellished with many legends, makes the claim that she was a niece of this saint. It is stated in the *Catholic Encyclopedia* that there exists a shorter text contained in a manuscript of the early eleventh century but that "internal evidences point to an original eighth century biography" although these are not specified.

A daughter who was born blind in about 660 A.D. was the first issue of the union of Adalric and Bereshinde. The enraged father lost no time in condemning her to immediate death; however, her mother secretly placed the infant girl in the care of an old female servant. Vision was reputed to have been bestowed upon her during adolescence, and, after parental reconciliation, she became a nun and the abbess of a convent which was actually the Castle of Hohenburg. She lived there for nearly a century and died in sanctity as a monastic saint.

The other recorded details of the narrative of Saint Odile are less well authenticated. She is said to have been transferred by her

mother for educational purposes from the care of the old servant to the Convent of Baume-les-Dames, the Mother Superior of which was an aunt of Bereshinde. Despite her blindness she was instructed in learned matters and became a patron of intelligence and of piety although she never had been baptized. It was at this period of her life, when she was somewhere between the ages of 6 and 12 years, that Saint Erhard (Erard, Everard, Erhardt, Eberhard, Herard), a bishop in the commissariate of Ratisbon, presumably fell into an ecstasy during which he received a call to proceed to Baume in the Rhineland to christen, by divine inspiration, a blind girl who was to be called Odile and who would receive sight with the sacrament. The promised miracle immediately followed baptism and, as she opened her eyes, according to Jacobo da Voragine, Saint Erhard said to her: "May you look at me thus in Eternity, my daughter;" or, according to Waite: "So, my child, may you look at me in the Kingdom of Heaven."

Adalric, shortly after the return of Odile's sight, was informed not only of the existence of a daughter whom he thought dead but, also, of the occurrence of the miracle. Accounts vary with reference to whether Saint Erhard was the purveyor of this news or if her brother, Hugh, had approached his father with the information. It is agreed, however, that Adalric, this unnatural parent, became very angry and not only refused Hugh's request that Odile be permitted to return home, but he forbade any mention of her name. Hugh sent for Odile in spite of the parental edict and he was standing with his father on a neighboring small hill when she arrived in a carriage, accompanied by a small crowd of local peasants. When Adalric learned the identity of the traveler and the manner of coming to his castle, he fell upon Hugh and effected his immediate death. Adalric then turned, however, in immediate remorse to his daughter and, after gazing at her for the first time, became as affectionate as he had been cruel.

Odile came to prefer to live in quarters provided by her father at Obernai. It is inferred that she wished to continue the type of activity for which she had been trained. She lived and worked for several years at Obernai with a few recruited companions who joined her in devotions and charitable works among the poor. Her father, upon her attainment to womanhood, arbitrarily arranged

for her marriage to a German duke. Upon learning of this plan she fled, closely pursued, in beggar's clothes across the Rhine and, as she was about to be captured by her father at the Schlossberg near Breiburg in Breisgau, was forced to hide under a rock beneath a cliff face. This opened miraculously to her prayer and gave her refuge. Her father again was profoundly impressed by the evidence of another new miracle when the rock opened to liberate her, with a new healing spring issuing from the fissure. This spring is consecrated and still flows at Odilienberg (Hohenburg), where there is a long vista over the Rhine Valley, Alsace, and Baden. It still is visited by many pilgrims seeking not only the curing waters for their ocular troubles but, also, the intercession of Saint Odile. Also to be found there is a small chapel dedicated to her honor; however, it is not claimed that this is the same chapel that she is said to have had built on the spot in commemoration of the event, when the rock gave her sanctuary.

When a reconciliation with her father was effected, consultations ensued, and she opened her heart to him, after which he permitted her to return to the family estates in complete freedom. She then expressed her desire to establish a convent for the purpose of the literal practicing by the nuns of the principles of the Gospel. He was prevailed upon to present to her, from his various possessions, his Castle of Hohenburg, situated behind Obernai. She altered the premises to suit her purposes and converted them into a convent to which Charlemagne granted immunity. This was confirmed on the ninth of March, 837, by Louis the Pious, who also endowed the Foundation. She became the abbess of 100 nuns and added a great church, in the chapel of which she was buried.

Saint Odile established a rule of life, probably on principles of her own, in her convent, but there exists considerable difference of opinion, according to Waite, with regard to whether this was of her own devising, that of Saint Benedict, or that of Saint Augustine. Pilgrims travelled to the convent in increasing numbers, but the steepness of the mountain was a discouragement and an inconvenience; subsequently, she founded an auxiliary convent at a lower level on the eastern slope of the Mount. This she named Niedermünster, and attached an inn, or hospice, to it.

Both her mother and father died in this convent during her long

and useful life. She is said to have succeeded in rescuing her father from purgatory by receiving supernatural assurance that her prayers and penances for him had been answered. In about 720, on her deathbed, at the age of 103 years, on the thirteenth of December, which, like that of Saint Lucy, is celebrated as her feast day, she was presented, it is related, with a chalice containing both elements of the Eucharist. She received it into her hands from a radiant angel in the sight of her nuns. It is implied by some authors of the lives of the saints that it was Saint John the Baptist who appeared to her and who also indicated at the time the site and dimensions for a chapel which he wished her to build in her honor. It is believed by others that this is more likely to have occurred at some time prior to her death, and this is indicated by the portrayal of Saint Odile and Saint John in an old work of Meckenem. The chalice remained with her after the communion and was placed in Hohenburg in 1546, in which year the abbey was destroyed by fire, on the Vigil of the Assumption. The abbey was destroyed and rebuilt several times subsequent to its first destruction. Some believed that the relics of this saint were preserved in spite of these events, but the fate of the heaven-sent chalice is unknown.

The cult of Saint Odile grew, and she became the patron saint of Alsace. Hohenburg (Odilienberg), which later was said by the faithful to contain the relics of its first abbess, became a renowned mecca for holy pilgrimages. Saint Odile, who is invoked for ocular affections, usually is represented in ecclesiastical art with two eyes reposing on the pages of a missal, or prayer book, and her vestments are those of an abbess, by which she is readily distinguished from Saint Lucy, to whom is granted the same emblem together with a martyr's palm, and who is also commemorated on the same day, the thirteenth of December. Baring-Gould has observed ambiguously that there may exist some difficulty between recognition and invocation of these two saints by reason of the narrative crediting Odile's miraculous acquisition of eyesight by baptism.

Saint Clair

Saint Clair (Claire, Clarus, Clarius), whose feast is celebrated on the fourth of November, was a priest and martyr of the ninth

century. He is invoked, chiefly in northern France, by those afflicted with inflamed eyes. Ophthalmia, according to Gordon, was known as Saint Clair's disease, but the term probably was employed generically rather than specifically. Saint Clair, after having been elevated to the priesthood in England, went to Normandy and lived as a hermit at Le Vexin (Vernon), in the Diocese of Rouen, adjacent to the Diocese of Beauvais.

There is much repetition of the name Clarus and of its derivatives in the several calendars, almanacs, and dictionaries. This may have been the result of carelessness by earlier compilers, or it may have been due to the tonal association of names, as well as to geographic inaccuracy. The French Benedictine, Usuard (Usuardus), according to the Benedictine monks of St. Augustine's Abbey, Ramsgate, placed the name of Saint Clair in the *Roman Martyrology* as of the ninth century. The *English Menology*, however, gives rather wide limits concerning the time during which he lived covering the period of 666 to 894. There is further confusion concerning actual dates because the *Roman Martyrology* in its chronological listing mentions a Saint Clarus whose feast is celebrated on the eighth of November and whose epitaph Saint Paulinus is said to have written. This Saint Clarus, who died a few days before his Master in 399, was a priest at Tours, an important community on the main highway to Paris from Nantes and Orleans.

Another Saint Clarus who is said, according to the Benedictine monks of St. Augustine's Abbey, to have been known to have lived and gained local fame in Normandy in the Middle Ages may very well be the Saint Clarus registered in the *Roman Martyrology*. Baring-Gould does not diminish the investigative difficulties by adding that Saint Clair occasionally is represented as a bishop, thus being mistaken for his namesake, Saint Clarus, a bishop of Nantes, which is a community situated between Paris and Vernon on the River Seine. Nor is it an aid to learn that there is still another Saint Clarus. The latter was an aged pagan priest at Roche-Guyon (upstream from Vernon on the River Seine), and he was converted to Christ by Saint Nicasius of Rouen after the former had been cured of blindness by the latter. The nature of the blindness is not specified, but Clarus later was ordained a priest and suffered a martyr's death (for reasons not recorded) with Saint

Pientia of Roche-Guyon. Martyrdom occurred in approximately 311. The feast day of this Saint Clarus is celebrated on the eleventh of October. And, lastly, there was a martyred Saint Clarus who was a bishop of Apt in southeastern France. He is the local patron against sore eyes and also the patron saint of tailors. His relics are in the parish church of Apt, where formerly his festival was celebrated on the second of January, but he now is honored also at Saint Cannot's Church in Marseille on the ninth of February.

In the interest of clarification some geographic mention should be made of northern France in the valley of the Seine. This is the region where the principal Saint Clair flourished, and this is fairly evident since the various compilers make similar mention of the several communities associated biographically with saints possessing this name. It seems most probable that there existed only one important Saint Clair who was invoked by those afflicted with inflamed or sore eyes, and it is his story that will receive particular attention here. It also may be observed that the name, "Clair," derives from the old French, meaning "clear," which, when usurped as a name for contemporary holy persons, gained the further significance of spirituality of grace, gaze, and of mind. It is speculative whether Saint Clair chose his name in France or acquired it earlier in England. It was not an uncommon name in the France of his time, but it was not brought to England until the Norman baron, Walter de Bienfaite, of Clair (the treaty town of Clair-sûr-Epte), in France, gave the name early in the tenth century to the English town now known as Clare.

Saint Clair was purported to have lived for many years a life of great seclusion and severity, in emulation of the Fathers of the Egyptian Deserts, after he had gone to Normandy from England to live in the then province of Neustria. He is reputed to have led a hermit's existence near Coutances, south of Cherbourg, after which he became a monk at Maudun. He attempted, as a hermit, to teach true religion by word and precept to those among whom he lived, and he continued to follow these principles throughout his life.

He settled after long wanderings in Le Vexin, either in or near the Diocese of Rouen or that of Beauvais. The story of his martyrdom relates that he lived somewhere in the neighborhood of a lady

of rank whose amorous advances he so frequently was compelled to repulse that it became necessary for him to take refuge in the forests in order to avoid revengeful death at the hands of two servants the spurned woman had sent to murder him. It is inferred that his eyes were of such beauty that he unwittingly caused the burgeoning of unrequited love in the unfortunate woman. His repeated flights ultimately, however, did not prevent his eventual beheading.

Saint Clair is among the few English saints represented in the famous wall paintings in the chapel in the Venerabile in Rome. His martyrdom is appropriately symbolized, since he is represented as carrying his head with one hand while bashfully covering his eyes with the other as, presumably, was his attitude when the lady cast her admiring glances on him. Although Saint Clair is invoked throughout northern Catholic France by those with diseased eyes, there exists no available record of specific instances of ocular cures effected by his intervention.

It is necessary in connection with Saint Claire to digress briefly with regard to Saint Clare (Claire, Clara, Chiara, Cera) of Assissi, who was a virgin saint and foundress of the Poor Clares. She was born on July 16, 1194, at Assissi, in central Italy, and took the vows of the ascetic life at the age of 18 years. She governed a community of nuns for 40 years, the last 27 of which she lived in illness. Pope Innocent III granted sanction for the privilege of extreme poverty and of living solely on the alms of the beneficent. It is from this custom that her order has ever since borne the title of the "Poor Clares." Her festival is held on the twelfth of August, but she is celebrated only locally in Italy and in isolated communities elsewhere, as a patroness against sore eyes. No specific instances of miraculous ocular healing are accredited to her; however, she is frequently depicted carrying or holding a lighted lamp.

Saint Augustine

Saint Augustine (Augustin, Aurelius), Confessor and the Bishop of Hippo Regius, was born on November 13, 354, at Tagaste in Numidia. He is included by name in the Canon of the Roman Mass in Gaul and in the Mozarakic Mass of Spain. The Greek Church does not honor him, but he is commemorated in the

Russian Church on the fifteenth of June. His festival is celebrated on the twenty-eighth of August, in accordance with the listing in the *Roman Martyrology*, and the Augustinian's keep his feast day as a double minor of the first class. He is the patron saint of theologians, printers, and brewers, and he is invoked against sore eyes, primarily among the Germanic Catholic States, but medical historians make no specific mention of this.

His impulsive nature as a youth led him, according to the various compilers, into an active life of vice, and it is considered that, in religion, he also went astray; however, from having been Hearer in the Manichaean sect, he ultimately proceeded to Rome and, thence, to Milan to teach rhetoric. The successive study of Neo-Platonic writings, the summons of Saint Ambrose, and the Epistles of Saint Paul served to bring him nearer to the Church. His conversion is related very graphically in his *Confessions*. After his baptism on Easter, in 387, and after a life replete with so many moral and intellectual errors, he began to live the life of a saint. He returned to Africa, was ordained a priest and, then, appointed preacher at the Church of Hippo Regius in 391 A.D. He was elected Bishop of Hippo in 395 and died there on August 28, 430.

The significance of Saint Augustine's name is similar to that of the other saints who have been discussed, and the ocular implications are identical. This saint, however, while credited with many miracles of a common type as well as some special types, receives no mention in the available sources with reference to the performance of miraculous cures of eyes in ill health; but he has been represented in ecclesiastical art in association with Saint Lucy and, questionably, with Saint Clair. Saint Augustine's life is well documented, and it may be for this reason alone that there exists little in the way of hagiographic legends concerning him, but it seems more acceptable that this lack is sequential to his intellectual stature and to the austerity that permitted little, if any, romantic appeal.

Comment

The almost universal need in times of stress for assistance greater than that commandable by the average person from within himself has eventuated through the ages in the evolution of a com-

mon, basic, supernaturalistic zenith, the form of which in the main has retained its familiar essentials from era to era, but whose outward embellishments have varied with the dictates of the changing environmental forces—whether antiquarian, pagan, or Christian. The interpretation of this known reliance in a higher power, but less than that of the Almighty, necessarily is expressed by each individual in terms of his own ambitions and endeavors; however, it should be the concern of those who administer to his biologic and spiritual requirements, real or apparent, not only to appreciate understandingly the factors productive of bodily ill health but, also, the equally important, more involved personality components that determine individual reactions and attitudes toward dysfunction and afflictions.

Faith in a belief, as one of these components, particularly requires sympathetic evaluation. It is not advocated that this faith be recommended as an agent of healing, whether by implication or by direction, but passively it may be utilized beneficially to promote an increased sense of well-being. If the practitioner is at all familiar with the basis of the beliefs encountered, and these are found so often among the members of our still unassimilated racial population groups, his therapeutic endeavors will undergo no deterioration if he does not deprecate the known but quiet need of the many for the supportive spiritual comfort that derives from a belief in the intercessory powers of the saintly martyrs.

The Human Eye*

Selig Hecht, Ph.D.

HOW the eye works, and the difference between day vision and night vision, are among the topics discussed.

OUR eyes are the most sensitive instruments we have for recording the presence of light. I say this in spite of photocells and electric eyes and amplifiers, because with our eyes alone we can see dimmer lights than any combination of gadgets so far devised.

Three major natural sciences—physics, chemistry, and biology—have made possible our knowledge of the eye, and much help has been given by mathematics and psychology. The earliest contributions were from physics, and showed that the eye is like a camera. Actually, a camera is a poor imitation of an eye, since we had eyes before we had cameras, and our eyes are more sensitive, more complex, and more flexible than the best cameras.

A camera is essentially a light-tight box with a lens at one end and a light-sensitive film at the other. The lens focuses a sharp picture on the film, which is then developed and printed.

The eye is also a light-tight box, but spherical, like a ball. At the front end is the lens system, which focuses a real picture of objects on a sensitive film at the back. In making an image, our lens system behaves just like glass, and follows all the laws of physical optics with fine precision. Indeed, when our lens system fails, as when we are nearsighted, or farsighted or astigmatic, we wear glass lenses to make up the deficiency.

The sensitive film in the eye is called the retina. As films go, it is

* Broadcast during the intermission of the New York Philharmonic Symphony program, May 6, 1945, under the exclusive sponsorship of United States Rubber Company.

small, about one inch square; and it is delicate and thin, being only 1/50 of an inch in thickness. Our knowledge of this film has come from chemistry. In a camera the film must be shielded from light until the moment of exposure, after which the film is finished. If another exposure is made on it, the result is confusion, as everyone who has made a double exposure knows to his sorrow. In the eye, however, the sensitive retina is open to light all our waking hours, and it acts as if new film were continuously exposed, immediately developed, and instantly replaced by fresh film. In short, chemically, the eye is more than a camera; it is a whole photographic factory.

When an animal is kept in the dark for some time, its retina becomes pinkish purple. If we shine a bright light on it, its color immediately vanishes. Back in the dark, its color slowly returns and, in the living eye, this reversible bleaching and regeneration goes on all the time. The pinkish color is due to a pigment, known as visual purple, which can be extracted from the retina and brought into solution. The bleaching and regeneration are chemical transformations, and can take place not only in a retina removed from the eye, but even in solution in the test tube.

Chemical studies of visual purple have clarified many properties of vision. For instance, one of the final products of bleaching visual purple is vitamin A. This shows that vitamin A or something closely related to it must have been part of the visual purple molecule, and explains why a diet poor in vitamin A produces night blindness. Without vitamin A, visual purple cannot be formed in the retina, and we become less sensitive to light.

Visual purple is not the only light-sensitive substance in the retina. Just before the war, another pigment was found with properties different from visual purple. This is called visual violet, and its discovery gives promise of clearing up things which puzzled us for years.

Although we have learned much about the eye from physics and chemistry, our basic knowledge comes from biology. The eye may be like a camera, or a photographic factory, but it is not made of glass and metal and cardboard and black paint. It is made of living, active cells. In the retina these cells contain visual purple and visual violet, and are concerned with recognizing the form, the

brightness, and the colors of objects. The retinal cells vary in size and density in different regions, so that some parts of the retina serve best for seeing detail while others are best for picking up the faintest lights. The retinal cells are joined to nerve fibers which connect them with the brain.

Every time a retinal cell is hit by light its visual purple or its visual violet is bleached, the cell becomes active, and sends a message along its nerve to the brain, and then we see. The pattern of these nerve impulses depends on the pattern which strikes the retina. Different shapes, different colors, different contrasts are registered by different patterns of impulses which surge up the optic nerve to the brain.

Biologically, the most interesting fact is that in a twenty-four-hour day we see over a tremendous range of illuminations. A landscape in sunlight is thousands of times brighter than the same landscape in full moonlight, and yet we see under both conditions. Starlight is even dimmer, and still we see by it. In fact, we can see light less than one-thousandth as bright as moonlight.

To deal with this huge range of illuminations we have two kinds of vision, day vision and night vision. Between sunlight and moonlight we use day eyes, while below moonlight we use night eyes. With day vision we see forms sharply, we detect delicate shades and shadows, and we distinguish colors. With night vision we perceive things vaguely, we recognize only coarse shadows, and we see no colors. But to make up for these lacks, our night vision is tremendously sensitive and can pick up the faintest lights.

Like ourselves, many animals have both night vision and day vision. But some animals have only one kind. Moles, owls, and mice operate at night and have only night vision. Other animals are active only during the day. Chickens have only day vision, and when the light fails they go to sleep. The same is true of turtles and of many day birds like hawks, who cease their activities at night.

City folks rarely use their night vision because houses and streets are well illuminated. But people in the country and in blacked-out cities have learned to use their eyes skillfully at night. One trick of night vision is to look out of the corner of the eye, because that way we see better than straight ahead. There are several other tricks, and, since night vision is important for the war, R.A.F. pilots and

navy lookouts, and now our air force pilots, are trained to use their eyes at night.

Under the best conditions at night, our eyes are unbelievably sensitive. Provided there is no haze or mist, you can see the light of a candle fourteen miles away, and, if you light a match on a dark night, an aviator ten miles away can easily pick it up. The light which enters the eye under such conditions is almost the smallest amount of energy that can exist. Light comes in little packets called quanta. Each quantum is an indivisible amount of energy, and you can't have half a quantum of light.

Well, when the eyes see the light of a candle fourteen miles away, only six or seven quanta actually reach the retina, where they are absorbed by the visual purple and send the nerve messages to produce a sensation of light.

The biggest unsolved riddle is how we distinguish colors. After the war, when we can again do pure science, this will be our next task. And, as before, it will take the combined efforts of all the sciences—chemistry, physics, and biology—to reach a solution.

Making the Best Use of the Eyes*

DISCUSSES lighting and other environmental factors which make for eye comfort and efficiency.

DEMANDS on sight vary greatly in both their nature and extent. Sometimes, as in walking, the eyes may be used quite casually and chiefly for distant seeing. Again, it is necessary to scrutinize objects closely and to perceive their details, as in reading, fine sewing, drafting and many types of industrial work. In some situations, the location of objects in space and their relative positions must be interpreted with accuracy and speed. Correct perception of colors is often essential to safety and efficiency. It may be necessary to be aware of objects or their motion in the peripheral field. Thus the various visual functions are called into play, usually in combination or with quick shifts from one to another, as from distant to near vision. Often, visual attention must be sustained on one type of work over a considerable period of time. All of this can be greatly facilitated by good visual working conditions.

Light and the Eyes

The eyes are provided by nature with the ability to adjust to great extremes of light. The opaque sclera, the dark lining provided by the vascular tunic, contraction and expansion of the pupils and lids, and the shading afforded by the brows and lashes, all help to control the amount of light entering the eyes in relation to the particular visual effort being made.

In dim light only gross seeing is possible and colors are distinguished poorly, if at all. For perceiving details and discriminating colors, a relatively bright light is needed; but glares (whether direct or reflected) cause discomfort and interfere with visual efficiency.

* Chapter IV of forthcoming volume, *Eye Health—A Teaching Handbook for Nurses*, soon to be released by the National Society for the Prevention of Blindness.

For example, it is undesirable to read in the sunlight, even if the reading material itself is shaded. The eyes function best when there are not too great differences between the brightness of the working surface and the surrounding area.

Sensitivity to Light.—Although individuals vary in their sensitivity to light, glares (bright spots within the field of vision) cause annoyance, discomfort and fatigue and lower the visual efficiency for all. With certain types of visual defects and ocular diseases, and during illness, light sensitivity is increased.

Sun Glasses.—Daylight is the natural environment for the eyes. Normally, one should be able to adjust to ordinary daylight without discomfort, although the eyes should be protected from prolonged exposure to sunlight by the use of either an eye shade or sun glasses. The latter, however, should be used only during the periods of exposure to sunlight, unless a more continuous use is recommended on the basis of a careful eye examination. The color of the lenses is largely a matter of choice, but sun glasses should not alter the hues of natural scenery. Indiscriminate use of sun glasses may tend to lower the tolerance to light. They are meant for daytime use only, and in night driving are a hazard rather than a help.

Lighting and Room Arrangements

As the arrangement and decoration of a room influence the amount and distribution of light, they are quite as important as the lighting provisions themselves.

Principles of Lighting.—Principles of illumination are the same whether natural or artificial light is used, namely, a sufficient amount of light for comfort and ease of seeing, correct diffusion, direction and distribution, and, above all, absence of glare. It is evident that the nature of the task to be performed and the condition of the eyes must be taken into consideration in determining the best lighting facilities.

Measurement of Light.—The amount of light needed varies in relation to the demands of visual tasks and to the needs of individuals, which differ with age and the condition of the eyes. Older

people and those with poor sight tend to need relatively more light than the young with normal eyes. Astigmatism, even of a fairly low degree, increases the intensity needed for detailed seeing, but also increases sensitivity to glare.

Amount of light is measured in foot-candles. One foot-candle represents the amount of light cast by a standard candle one foot away from the light. Ten foot-candles is the amount of light cast by ten such candles at the same distance. This is considered the minimum for reading even for a short time. When prolonged, detailed eye work is to be done, more light is needed.

Fixed standards for quantity of illumination are, of course, not possible because of the variations already noted. However, desirable minima have been established for schools and industries.

Although scientific evaluation of lighting is a special field, simple and inexpensive light meters make possible fairly accurate measurements. Light meters should be handled with care, kept covered when not in use, and periodically serviced and checked for accuracy. Frequently, they may be borrowed from local departments of education or health, or from a lighting company, or be purchased through the latter or directly from several manufacturers of standard electrical equipment.*

The individual who has become accustomed to his working conditions may not realize that the illumination is preventing him from doing his work with ease and efficiency. Indeed, at times he may object strenuously when improved lighting is provided. Experience shows, however, that conditions conducive to visual efficiency will prove comfortable after prejudices have been overcome.

Lighting Arrangements.—Daylight is to be preferred to any type of artificial light, but in a room where any kind of close work is done it must be supplemented by artificial illumination to make adequate provisions for all parts of the room, for dark as well as bright days, and for night use. Windows should, however, be used to the fullest possible advantage. The nearer these go to the ceiling, the farther they will cast light across the room. Shade, blind and

* Information concerning the availability of light meters may be secured from the National Society for the Prevention of Blindness, 1790 Broadway, New York 19, N. Y.

curtain arrangements can help to direct and diffuse the light and should be planned in relation to the purpose for which the room is to be used. Buff, translucent shades help to diffuse light and, where desirable, the use of separate shades for each sash permits control of the light from the upper and lower parts of the window. The slats of Venetian blinds, on the other hand, all turn together to direct the light up or down and thus tend to increase the shadows. Hence they are often unsatisfactory for rooms where much close work is done. Clean, light-colored walls and ceilings aid in the diffusion of light. Dull-finished surfaces throughout the room and on working surfaces help to minimize glare. Cleanliness of walls and ceilings is important in maintaining maximum reflection value of their surfaces.

Turning furniture at approximately 30 degrees away from windows helps to prevent glare and permits taking maximum advantage of the daylight for visual work.

For handwork, arranging for the light to come over the shoulder opposite from the hand used prevents a hand-shadow on the work.

Artificial Light.—Artificial light should approximate daylight in its diffusion as well as in its coloring. At present, white incandescent lamps are generally believed to give the best results as to color of light. Some blue of "daylight" bulbs is useful in matching colors, but less satisfactory for reading and general purposes.

Fluorescent lighting is now being widely advocated by lighting authorities and will undoubtedly have increasing use in the future. However, although it consumes less current and is therefore cheaper to operate, the installations are costly at the present time. Hence there is a tendency to use fewer and cheaper types of fixtures, resulting in inadequate distribution and diffusion of light. The stroboscopic effect, or flicker, found in the earlier installations has been practically eliminated in the newer ones. Despite these improvements, current research is leading some ophthalmologists to caution against installing fluorescent lighting at its present stage of development.

There are four general types of installation used in artificial illumination: direct lighting, in which, as the name suggests, the light is all directed downward; semi-direct lighting, in which the

greater amount is directed downward; semi-indirect lighting, in which more than 50 per cent of the light is directed upward and reflected from walls and ceiling over the area to be illuminated; indirect lighting, in which 90 per cent or more of the light is directed upward.

The selection of the system depends upon the type of work to be undertaken. Ceiling fixtures or luminaires may be used, or a combination of ceiling luminaires and supplementary local lighting, such as floor, desk, and table lamps. In general, the indirect or semi-indirect types of illumination are most satisfactory, although for work requiring careful inspection supplementary direct lighting units are necessary. These should be so shaded and placed that there is no possibility of the light shining into the eyes of the worker. If supplementary lighting is needed for reading, writing, sewing, etc., a floor lamp providing semi-indirect illumination may be so placed that the light comes over the shoulder.

Lighting the Home.—Overhead semi-indirect illumination provides good distribution for home use, supplemented where necessary by direct illumination over working surfaces or by semi-indirect reading lamps.

In the kitchen, a ceiling fixture with a diffusing globe may be the most satisfactory for general lighting, with properly shaded direct lights over worktables and the sink. Indirect light is adequate in a dining room used for meals only; but if the room is used also for reading and study, the light should be supplemented by semi-indirect reading lamps, preferably the floor type. Similarly, in the living room, reading lamps—both floor and table type—are needed so that each member of the family may have a comfortable place in which to read or do other types of visual work.

In bedrooms, soft overhead lights are desirable, and may be supplemented by properly shaded lights on both sides of the mirror. Similar lights may also be used in the bathroom to supplement the overhead light. A semi-indirect pin-up lamp over the head of the bed usually provides the most satisfactory light for reading in bed. This practice is not harmful to the eyes if the reader maintains normal posture, if the book is carefully placed for comfort of seeing, and if the light is adequate in quality and quantity.

In children's rooms, a combination of overhead and wall fixtures with semi-indirect lighting provides the general and localized lighting necessary, and eliminates the accident hazards from floor and table lamps.

Halls and staircases should receive special attention. In the former a diffused type of lighting is to be preferred, while a semi-direct type will usually light stairs adequately. It is particularly important to avoid the use of a glaring type of lighting on a staircase.

Visual Comfort for the Sick.—Light is often a source of much discomfort during illness, when light-sensitivity may be increased. Whether from a natural or an artificial source, the light should not shine in the patient's face. If possible, the bed should be so placed that the patient will not face the window. If this cannot be arranged, the light should be controlled by adjusting the shades and, if necessary, using a screen. Lights from overhead fixtures should be shielded. When permitted at all, reading or other close work should be limited to brief periods when the patient is not fatigued. Attention to posture, lighting, and the angle at which the book is held will help prevent undue fatigue. Back rests and reading racks are very useful for this purpose. For the patient who must lie flat, special arrangements for reading are necessary to maintain the proper angle between the eyes and the book and to provide adequate light. Here a reading rack is essential unless the doctor permits the slanting of the whole bed.

Lighting the School.—Lighting the school* presents many problems. Classrooms which permit the maximum use of daylight are those with a glass area equal to at least one-fifth of the floor space, and extending close to the ceiling.

Natural illumination should be controlled by two light-colored, translucent shades placed at the center of the window, one rolling up and the other down.

Children's desks and seats should be movable, so they can be turned diagonally from the window to permit the maximum use of

* *American Recommended Practice of School Lighting.* Illuminating Engineering Society, 51 Madison Ave., New York; and The American Institute of Architects, Washington, D. C., 1942, 25c.

daylight and to avoid glare. For the right-handed, the desks should be turned at an angle which allows the light to come over the left shoulder, while for the left-handed the light should come over the right shoulder.

To encourage good posture and good visual habits, the children's desks and seats should be adjusted as to height and spacing as often as necessary for their growing bodies. Desks with adjustable, sloping tops also facilitate good visual habits and good posture.

Artificial light is needed in all classrooms to supplement the daylight, especially on dark days. In many classrooms it must be used continually on the side of the room away from the windows; hence the rows of luminaires should be on separate switches, to control the lighting from the two sides of the room. The artificial lighting should be adequate in itself to provide at least the minimum recommended amount, especially if the room is ever to be used after dark. For ordinary classrooms, the recommendations indicate a minimum of 15 foot-candles on desks and other working surfaces for children with normal vision, and 30 foot-candles for those with seriously defective vision. Higher amounts are recommended for places in which detailed or close eye work is carried on. Semi-indirect light or indirect luminaires with translucent bowls appear to give the most satisfactory results.

Glass doors and other shiny surfaces should be covered or eliminated to reduce glare. Chalkboards reflect very little light; hence they tend to reduce the amount of light on working surfaces. This can be overcome by the use of light-colored curtains to pull over those not in use.

Corridors and stairways should be adequately lighted at all times.

Lighting in Industry.—In industry, lighting is an important factor in safety and production. Well-lighted corridors, aisles and stairs help to prevent accidents. Such lighting should be diffused, free from glare and of adequate amount to permit obstructions or steps to be seen easily and clearly. For detailed and exacting work, general illumination usually must be supplemented at the work point. Such lights should be shielded to prevent glare either for the individual worker or for those nearby. Glare may also be reduced

and seeing facilitated by painting the machines with dull-finished paints, using contrasting colors for various parts of the machine. Certain types of inspectional work are facilitated by what is called "directional lighting"—light directed on the work at such an angle that even very slight irregularities on the surface are easily discernible.

Because of variation in the visual demands in industry, no generalization can be made regarding amounts of and arrangements for desirable illumination. However, specifications have been developed for recommended practices of lighting for particular types of work in various industries.* The amounts suggested indicate the minimum light needed at the work point and for general lighting. Periodic checks with a light meter are necessary to be sure the light continues to be adequate. Plant housekeeping is an important factor in good lighting. Clean, light-colored walls and ceilings with dull finish reflect the light without contributing to glare. Clean windows and lighting fixtures, and replacement of deteriorated bulbs, increase the amount of light available from these sources and prevent wasted illumination. Routine schedules should be arranged for maintaining these facilities at maximum efficiency.

Minimizing Fatigue Through Arrangements of Work.—Comfortable working positions contribute to visual and bodily comfort and help prevent undue fatigue. Viewing work at the normal angle to the eyes and at appropriate working distances is conducive to good posture and results in less general muscular strain. Adjustable seats facilitate good posture; and desks and work tables with tops which can be slanted encourage keeping the head up rather than bending over work. This is particularly important for those with seriously defective vision and those who do continuous eye work at short range, as they tend to bring their eyes close to the work and thus develop poor posture.

The spread and shape of the working area should also receive consideration in relation to the type and continuity of visual attention required. In this connection it is necessary to remember that details can be perceived only in the direct line of vision, and,

* *American Recommended Practice of Industrial Lighting.* Illuminating Engineering Society, 51 Madison Ave., New York, 1942, 25c.

if these are not directly in front of the individual, the eyes or head must be turned to obtain clear impressions. Some types of visual work may be slowed up by too great a spread, and fatigue may result from such continued efforts, especially if speed is necessary or the individual's visual capacities and general co-ordination are not equal to the demands. Accident hazards may also arise from the necessity of taking the eyes from a central point to look at something elsewhere.

Distractions caused by moving objects in the peripheral fields of vision increase fatigue because of the nervous strain of striving to ignore these; or an accident may result if attention is thus distracted momentarily from the central point.

Reading Materials.—Reading requires accurate discrimination of fine detail and speed in seeing and can be greatly facilitated by the use of reading materials of good quality and workmanship. Although it is questionable whether reading poorly produced materials injures the eyes, the greater ease and comfort with which high-standard materials are read lessen fatigue and nervous strain, and make careful selection of reading material well worth while.

The quality of printed and typewritten material may be judged by its freedom from glare, its general appearance, and its distinctness. Glossy paper and ink are to be avoided because of reflected glare. Contrary to popular belief, green paper is less "easy on the eyes" than dull-finished white or cream-tinted paper, because it offers less contrast between the print and the background. Wide margins are to be preferred, and lines of print are more easily read if not over 4½ inches in length; typed lines should not exceed six inches. Sufficient space between letters and lines to avoid a crowded appearance makes reading more comfortable. Plain type with sharp edges is the most distinct. Type sizes are indicated in points, the lower numbers referring to the smaller sizes. Newspapers are usually printed in six-point type, while the type of this text is 11 point. For general use, type sizes smaller than eight or larger than twelve point are less satisfactory; larger type is, however, necessary for very young children and for those with certain degrees or types of visual defects.

Can You See What You Are Doing?*

Charles P. Tolman

DISCUSSES in popular language how to make the best use of our eyes, whether at work or at leisure.

MOST of us take our eyesight for granted and give little thought to protecting it. We suffer from eyestrain and do nothing about it. We go without glasses even when they have been prescribed for us. Further, we even let our children study or read without proper light.

If we had to brush our eyes twice a day, as we do our teeth, we might see our eye physician at proper intervals, as we have been taught to see our dentist. Our dentist can replace a diseased tooth with a reasonable facsimile. We can eat with it. But eye trouble, neglected too long, is a different matter—there are no spare parts for eyes.

Hundreds of eye physicians, optometrists, illuminating engineers, experts in the use of color, and others, have studied the problem of better visual conditions for industrial workers. Their findings have been embodied in a national program for improving visual conditions in industry.

A survey made early in the war by the National Society for the Prevention of Blindness showed that industry in general did not understand the importance of eye care and eye protection. To meet this need an educational program was developed, outlining what should be done, why it should be done, and how to do it. The program was brought to the attention of Mr. Donald Nelson, then chairman of the War Production Board. He quickly recognized

* Radio talk over Station WYNC, under auspices of the New York Tuberculosis and Health Association and the Medical Information Bureau of the New York Academy of Medicine.

the importance of better vision for better war production, and the program was taken over by the War Production Board. In his letter to American industrial executives requesting co-operation, Mr. Nelson said: "When a job needs vision, a man can work only as well as he can see."

The War Production Board was joined by the United States Public Health Service, War Manpower Commission, United States Department of Labor, Office of Vocational Rehabilitation, and United States Civil Service Commission as co-operating agencies; and the National Society for the Prevention of Blindness was engaged by the War Production Board to prepare material and to direct the program. Advice concerning visual conditions went to 25,000 industrial executives.

As a result, six government agencies and the employers of 8,000,000 workers are co-operating to safeguard eyesight in their plants. Studies among these industries included individual attention to the eyesight of workers, proper lighting, and the use of color in painting workrooms and machines.

Eye care of employees includes examination of eyes and provision of glasses for those who need them. If there is any limitation in the employee's vision which cannot be corrected by glasses, he is assigned to work in which this limitation will not interfere with his efficiency or earning capacity.

The most amazing information gained from the industrial investigation is the very large number of persons who thought they were seeing "all right," when, as a matter of fact, their vision needed the benefit of glasses. In general work, four out of every ten workers were found to need glasses, while, in office work and in the needlecrafts, six out of every ten needed this help.

Since thousands of persons—men and women, young and old—were employed in plants participating in the program, it seems fair to assume that these conditions prevail among the general public. This may sound unreasonable to those not working in industry. However, the eye task of "seeing" things is much the same whether one is reading proof in a publishing house or reading a book at home. The same thing applies to sewing and other household tasks. In all cases, the eyes are being used to see something. How well they can see is a question of whether glasses are provided, if needed,

and whether the light and the surrounding conditions are best for the eye task.

Eyes, alone, cannot see. We must also have light. To see well and with comfort, we must have enough light without glare and without too great a contrast in brightness between the surroundings and whatever we are looking at.

Reports from concerns employing 800,000 workers revealed that less than half had illumination that met the American Recommended Practice of Industrial Lighting. This is a poor showing. Nevertheless, industry, with its lighting job half finished, has done more for the eyes of its workers than we have done toward improving illumination in our homes for the eyesight of our families.

Underlighting the home is about the most costly thrift that can be practiced. Of course, lights which are not being used should be turned off, but, when they are needed, "let there be light!" Many power companies have exhibits where you may see for yourself the difference between good and bad lighting—and lighting is important enough to you and to your family to justify spending some time in investigation.

Glare is the enemy of good, comfortable seeing. We speak of "direct glare" and "reflected glare." Direct glare is light striking the eye from the lamp itself. An example of its effect on seeing is experienced when driving a car at night. We cannot see the road because the brightness of the headlights of other cars is greater than that of the roadway. An unshaded bulb in your home will do the same thing. We experience reflected glare when we hold a book so that the page reflects the light into our eyes. Try this experiment tonight: sit in your usual position for reading—hold the book just as you always do. Now place a small mirror flat on the page you are reading. If you can see the lamp bulb in the mirror, the page is reflecting glare. Move the lamp or turn your chair to correct the condition. Form the habit of reading with the correct arrangement of yourself, your book, and the light.

"Relative brightness" means the brightness of the surroundings contrasted with the brightness of the object which is being looked at. Just as bad "seeing" results when the surroundings are brighter than the object, so bad "seeing" also occurs when the surroundings are too dark in contrast with the object. The condition is particu-

larly bad when one has to look back and forth from a bright area to a dark one. When this is done, the pupil of the eye is contracting and expanding with the changes in brightness, and fatigue may result. An example of this is work done at an office machine where the operator is looking, first, at figures on *white* paper, then at a *black* machine. In the home, bright lights and dark furniture produce a similar, but less serious, effect. The modern trend toward blond furniture may be a fad, but it is also a step in the right direction.

Pleasing color effects lend themselves to adjustment of relative brightness and general improvement in seeing conditions. Paint manufacturers offer the services of specialists in the use of color to help in problems of this kind.

Now a few words about glasses—particularly about what industry calls "glasses for the job."

Everyone has used a magnifying glass at one time or another and found that it had to be held at a certain distance for the best result This principle applies particularly to glasses for persons of middle age. Ordinarily, reading glasses are designed for reading at a distance of 14 to 16 inches. But suppose an individual is doing work that is more, or less, distant from his eyes—for example, at a desk, using a typewriter, playing a piano, or at a machine in a shop. If he needs glasses for such use, he should measure the distance from the work to his eyes. When he goes to the eye doctor, he should tell him about this measured distance and about the kind of work he does. The doctor must have this information to prescribe suitable glasses. Different ones may also be needed for reading. If so, they should be obtained, because eye health and comfort are worth the added investment.

Superstition is a great enemy of eyesight. The mistaken ideas about eyes and glasses would fill a book. A common saying is, "I won't put on glasses because my friend did and now she has to wear them all the time." The facts are, of course, that the friend needed glasses very badly and finally got them. She wears them all the time because she appreciates the improved vision and eye comfort.

Sometimes, good, healthy eyes may need glasses. On the other hand, some persons with diseased eyes may see clearly without

glasses, and have no realization that there is any trouble until it is seriously advanced.

Many workers, it was found, did not know that they were not seeing well until they were fitted with the proper glasses. Instances were found in which the worker was blind in one eye and did not know it until his eyes were tested. While nothing can be done about cases like this, there are many who are doing practically all of their seeing with one eye because of deficient vision in the other eye. Of these, a large number can regain the use of the deficient eye, under proper care by an eye physician.

Difficulty in seeing clearly is not always just a matter for glasses; a diseased condition may be present. It is unfortunate that in some of these cases glasses may seem to help for a while, and so cause a sad delay in consulting an eye physician.

In one group, nearly half of those not wearing glasses were found to need them in order to see clearly and without eyestrain. Perhaps even more serious is the condition of those who needed medical attention for their eyes and did not know it. On the average, there was one such out of every twenty-five persons.

It has been possible to present only an outline of some factors which make for good and comfortable seeing. Some of these factors have to do with surroundings; others, with the individual's care of his eyes— his personal responsibility. Whether he wears glasses or not, or if his eyes trouble him, he should check the lighting under which he uses his eyes—if the trouble persists, he should see his physician. Perhaps only a new prescription is needed, but it may be that more serious attention is required. The best insurance for continued eye health and comfort is periodically to obtain qualified professional advice.

Orthoptic Fictions and Misconceptions*

Louisa Wells

AMONG other topics, the author describes the practicability of orthoptic eye exercises in the treatment of cross-eyes.

THE subject of orthoptic misconceptions and fictions affords wide scope and a valuable opportunity for brief presentation of the many problems confronting the ophthalmologist and the orthoptic technician in the treatment of squint.

One of the misconceptions that has existed throughout the ophthalmologic world for the past thirty or forty years is that vision in an eye affected with amblyopia ex anopsia cannot be improved after the sixth or seventh year of life. Worth[1] states that after the sixth year an amblyopia due to disuse can no longer be improved. This has not been our experience. In both hospital and private practice we have been able to improve vision, by means of total occlusion of the good eye during all waking hours, in most young children, in many adolescents, and in a few adults. Treatment that consists of wearing an ill-fitting rubber or plaster occluder for only several hours daily is of no avail. The occluder must be kept on all day long. Occlusion by means of Scotch tape, Chavasse glass, or by any other means of clouding the lens before the good eye is practical in some cases for the adolescent, but is impractical for the child. It can never be as expedient as total occlusion with adhesive tape, moleskin, or any pad that excludes all light and prevents the patient from using the good eye.

Because of economic or psychologic reasons, it is not always possible, practical, or desirable to occlude the eye of an adolescent or

* From the Department of Ophthalmology, George Washington University School of Medicine. Read before the Symposium on Orthoptics, Academy of Ophthalmology and Otolaryngology, Chicago, October, 1944, and reprinted with permission from the *American Journal of Ophthalmology*, August, 1945.

adult patient. However, if the patient desires to better his vision because of some visual standard that is required of him for some specific endeavor—such as entering the Air Corps or the Military or Naval Academy—the psychologic effect of the occlusion is generally nil. Such a boy does not care what others think when they see him wearing the occlusion; his comrades are informed of its purpose and, as the vision begins to improve, his enthusiasm spurs him on to further co-operation. We have also seen a number of adolescent girls who have been anxious to improve their vision and thus were quite willing to wear occluders. These young people were never forced to wear them; they were asked if they would be willing to try occlusion and they consented. If co-operation waned and they confessed that they were embarrassed about it or it was too much trouble, occlusion was stopped. We feel that the bad psychologic effect is often worse than the amblyopia.

To state that vision cannot be improved after the child has reached the age of six or seven years is to admit never having occluded the patient properly and for a sufficient length of time.

There is so much that we do not understand about amblyopia ex anopsia. Some patients with vision of less that 20/200 will improve at least one line a month, and sometimes more. Others, with vision of 20/50 to begin with, will take six months to attain 20/30 and will not improve beyond this point. The vision in some eyes improves very slowly, as seen sometimes in cases in which there has been an amblyopia during the entire life of the patient. A cataract begins to form in the better eye and, as the crystalline lens becomes opaque, the vision in the amblyopic eye begins to improve slowly. No one can say with certainty that this case of amblyopia will improve and that case will not. There is only one way of finding out and that is by initiating occlusion in young children, whenever possible, and in as many older boys and girls as are willing to try because they need to have better vision for some educational or vocational enterprise. It is necessary, indeed, to use good judgment and sound, common sense in selecting cases for occlusion, and to realize that one is dealing with a human being and not just a pair of eyes. Each case should be considered individually, otherwise much harm may be done to the patient psychologically.

Many cases of amblyopia ex anopsia have developed because the

pediatrician and the general practitioner have not been sufficiently informed by the ophthalmologist of the complexities of squint. When the mother informs the doctor that she has thought her baby's eyes were crossed at times, she has been advised to "wait and see." As Dr. Hardy[2] so aptly states: "This generally means wait, and do *not* see." By the time the child is brought to the ophthalmologist he may have a high degree of amblyopia and suppression, inasmuch as the foveal fixation of a young child can be lost very rapidly indeed.

No matter how young the child, he should be brought to the ophthalmologist for careful study and preventive treatment—treatment directed toward prevention of amblyopia and anomalous correspondence and correction of the refractive error, if it be necessary. Often this "wait and see" injunction brings needless worry and anxiety to parents who are greatly upset because of their baby's crossed eye, when in reality he may have only an epicanthus or other abnormality creating the optical illusion of squint. If they had brought him to the ophthalmologist, their fears would have been at once relieved when they found that squint did not exist. However, we have seen cases of epicanthus combined with an intermittent accommodative convergent squint. When the baby was in the office only the epicanthus was noted, inasmuch as the child would not use his accommodation and therefore did not squint. It is sometimes very difficult to make an infant accommodate, but every effort should be made to do so or the squint may be overlooked. We therefore feel it is of paramount importance to observe monthly all cases of epicanthus until it can be very definitely decided that there is or is not a squint. It is very easy to assume that because a child has a marked epicanthus he has no squint.

This waiting may preclude a functional cure. During these years amblyopia and anomalous correspondence may have become fixed, thereby prolonging the treatment many months and sometimes a year, in some cases resulting in a cosmetic cure only. In these days, when binocular single vision is a necessity in so many fields of endeavor, the lack of it is a serious handicap.

Frequently, mothers tell us that they have been advised by the family physician to wait "until the child is four or five years of age because otherwise he would be too young to be examined." This

misconception of the steps necessary to treat a squint, and of the complications that can ensue in a case that has been neglected, is very unfortunate. Eyes of infants can be occluded to prevent amblyopia before they are mature enough to give any subjective visual findings. It is also possible, with patience and ingenuity, to measure the amount of the squint with the prism and cover test, examine the rotations that are of such great importance, secure an objective reading on the major amblyoscope, test the near point of convergence, and estimate the refractive error under atropine in children as young as one and a half to two years of age. It may take several visits, but rarely do we find that these little tots will not co-operate. Most of them are highly amused with the procedure. We examine them quietly and slowly, take the time to play with them and gain their confidence, and permit them to hold the paddle and the plastic prisms used for the cover test, so they will not be alarmed. As the plastic prisms will not break, we have found them to be invaluable in examining timid children.

After an average of five or six visits, it is usually possible to come to a conclusion as to whether one is dealing with a mechanical, accommodative, or paretic strabismus, and whether it should be treated orthoptically, surgically, or both. If a vertical deviation exists, it may take many months before an accurate diagnosis of the type of motor disturbance can be made in very young children. Since most ophthalmologists now believe that surgery can be performed as early as in the child's third year, it is necessary that the diagnosis be made as early as possible so that, if mechanical or paretic factors are present, operation can be performed early, thus giving the little patient a chance to attain and stimulate fusion. The earlier the eyes are straightened, the greater the chances that the sensorial apparatus will be stimulated to attain normal fusion power, and the less likelihood there will be of amblyopia and anomalous correspondence. With intelligent children, orthoptic training can be instituted at the age of four years. In this way there is an opportunity of curing the squint before the child starts to school, which is of extreme importance for his future.

Another fiction in orthoptics is that "alternating squints cannot be taught to fuse." If a major amblyoscope is used and the image set before the macula of each eye at the angle of squint, fusion can

be obtained as long as the fusion sense in the cortex is present. Cases wherein the fusion sense appears to be absent are in the minority. We believe that the misconception has probably arisen from the fact that patients with alternating squint were tested on stereoscopes, the Worth amblyoscope, the Rotoscope, and other instruments mechanically so constructed that the images could not be placed before the maculas. A stereoscope can be used for a convergent or divergent squint of not more than 20 to 25 diopters. Prisms can be added but, if of high degree, produce distortion of the pictures. If the child has an alternating convergent squint of 70 diopters, he will use first one eye and then the other when placed before a stereoscope, and no attempt will be made to use the two eyes together with the images falling on the maculas. Even if the squint is only 20 diopters, he may not stop alternating as he looks into the stereoscope, since there is not stimulus strong enough to break up the habit of alternation. If, on the other hand, the major amblyoscope is used and the images are set before the maculas at the angle of squint, the patient cannot get rid of the images which are being constantly projected on his maculas, except by suppression. With oscillation of the images, peripheral fusion will begin to be established, and later on in the treatment, when the suppression has been overcome, foveal fusion will occur. In cases of alternating squint that have been present since birth, fusion may never be attained, but this group is small. In the definitely larger group wherein the squint has appeared in the first to third year of life, at least 50 per cent have anomalous correspondence. This fact alone proves that the fusion sense in the brain is active, or there would never have been any desire nor attempt to secure binocular single vision, no matter how poor. An alternator who has no sense of fusion *never* makes any attempt to obtain two-eyed vision, even by anomalous correspondence. If the fusion sense in the brain is entirely inactive, anomalous correspondence will never be manifest for this is a binocular act, and where no fusion sense exists monocular vision only will result.

Anomalous correspondence in an alternating divergent squint is rare; in convergent squint it is quite common, in cases due to mechanical or structural anomaly, because the fusion sense in the brain cannot function properly. Therefore the brain employs the

next best thing, which is using the macula of one eye and an eccentric area in the other. As most of the alternating convergent squints fall into this class, they are therefore no more difficult to treat than are cases of unilateral squint.

Here may be emphasized another misconception regarding anomalous correspondence; namely, that it cannot exist in a patient who has 20/15 vision in each eye. This belief is probably based upon the assumption that, because the vision is acute in each eye, the patient would have no desire to use an eccentric point in one eye for this would give him vision that is less acute than macular vision. This is not true for the reasons just explained under alternating squint. A squint in which there is equal and good vision in each eye is obviously an alternating squint, and it seems to be the common experience of the clinics in the United States and England that there is a high incidence of anomalous correspondence in alternating squint.

Until she gains experience, the orthoptic technician is often working under the misconception that "a shift of the eyes, when the light in the major amblyoscope is flashed, indicates that anomalous correspondence exists." This is a grave error which will retard very much the successful treatment of the squint case. True, when anomalous correspondence does exist, there is *always* a shift of the two eyes as each eye seeks to receive the image on the macula, but there can also be a shift for other reasons; namely, (1) varying accommodative factor; (2) the breaking up of fusion. The reflex from the light in the major amblyoscope, however, will never be eccentric in one eye unless there is anomalous correspondence. If the shift is due to varying accommodation or the breaking up of fusion, and not to anomalous correspondence, the light reflex will always coincide with the angle gamma, if present. This constitutes the differential diagnosis. When a patient with high hyperopia who has an accommodative squint sits before the major amblyoscope *uncorrected*, there can be a shift of as high as 50 diopters or more; as he relaxes his accommodation he may fuse the picture with *blurred images* at a setting of only 20 diopters, but, if he is asked to describe some minute detail in a picture that is small enough to make him accommodate *fully*, the angle may immediately increase, perhaps to 50 diopters again. Having seen the

object in which he was interested, he may now relax his accommodation sufficiently to fuse gross charts at orthophoria with blurred images. However, it will be noted that the position of his corneal reflexes is the same at all three angles and that the maculas are being used. In cases with such a high shift one is not so easily misled, but in cases where the shift is approximately 10 diopters keen observation is necessary. If the irides are very dark it sometimes takes several visits before the orthoptic technician is completely satisfied as to the type of correspondence. The maximum angle of squint may be only 25 diopters when the eye is fully accommodating, with relaxed accommodation approximately 15 diopters, and it may be difficult to decide whether the corneal reflexes are in the same position at the two settings because the iris and the pupil are almost of the same color. In these doubtful cases we always make the after-image test described by Bielschowsky,[3] as well as the major-amblyoscope test. The type of diplopia, whether homonymous or crossed, is tested with red and green spectacles, and the diplopia corrected by as much prism, base out or in, as is necessary to fuse the two images. This test is a helpful diagnostic aid *when it can be carried out.* Suppression and alternation will often prevent a satisfactory conclusion, and in such cases it is worthless and may be misleading. If the correspondence is normal in a convergent squinter, for example, the homonymous diplopia at six meters will usually take approximately as much prism, base out, to correct as the amount obtained on the major-amblyoscope reading; if the correspondence is anomalous, the diplopia can still be homonymous instead of crossed, but the amount of base-out prism may closely simulate the abnormal angle on the major amblyoscope. Three tests are therefore made: the major amblyoscope, the after-image, and the diplopia test. It is quite possible to find normal correspondence by one test and anomalous correspondence by another. The correspondence may vary with such factors as whether the after-image test is made for six meters or one meter, and whether in a light or a dark room. The diplopia test may give normal correspondence for distance and abnormal for near. These are the patients who use both types of correspondence. It is advisable to study the cases carefully, as soon as a shift of the eyes is observed, and to remember that the

variations in the motor anomalies of the eyes are many and that we cannot be bound by rigid rules.

Lancaster[4] states that "many ophthalmologists still cling to the conception that disturbances of motility are due fundamentally to 'muscle trouble' some muscle is weak or some muscle is too strong. Inevitably they think of the orthoptist's work as trying to strengthen some weak muscle." As Dr. Lancaster points out, this is a misconception. Orthoptic training stimulates the sensorial apparatus in the cortex; exercises are not given to stimulate "the muscles." Correct habits and skills are taught. Anomalous correspondence, a bad habit, is corrected by establishing through re-education, good habits of binocular single vision. Fusion is stimulated and a strong amplitude of fusion sought. Proper relationship between accommodation and convergence is taught. All this is cerebral and will not "stretch" muscles nor make one muscle weaker or stronger. The attainment of strong fusion and binocular single vision will serve as a stimulus to keep the eyes straight, if an anatomic or mechanical factor or the faulty position of rest does not make this impossible. For example, eyes will remain straight, following orthoptic training in purely accommodative squint, because we teach the brain to make it disagreeable for the patient to turn the eye in. We teach the brain to overcome suppression; hence, diplopia will be manifest if the eye deviates. After a while, the bad habit of turning the eye in or out disappears because the good habit of binocular single vision is so much more satisfactory and comfortable for the patient. We have simply established a new habit pattern.

On numerous occasions it has been said: "If a squinter is a hyperope he has to wear his glasses anyway, so why bother with orthoptic training?" The orthoptic technicians in Washington, D. C., feel this to be a misconception. As Davis[5] stated: "To be content with this treatment, however, is a tragedy, since it condemns the child for life to the wearing of strong glasses continuously. It is symptomatic treatment only." By dissociating the convergence from the accommodation, it is possible to give *intelligent* patients with purely accommodative squint, hyperopia of not more than 4 diopters, and little or no astigmatism, clear vision without glasses. Hence, we feel that orthoptic training is of the utmost

value, because the patient can be taught to keep his eyes straight without glasses and without converging for distance and in many cases for near.

Another misconception is that the treatment of squint is often carried out according to the degree of the deviation, and not of the type, of squint. The amount of the angle of squint is of secondary importance, compared with obtaining a differential diagnosis of the kind of squint with which one is dealing. Not until one knows what is causing the squint can it be treated intelligently. Burian[6] states that "the three factors causing the appearance of a periodic or manifest strabismus are: faulty mechanical conditions, abnormal innervational conditions, and a lack of fusion." Bielschowsky[7] also classifies squint in this manner. We have found this classification to be the most satisfactory and expedient guide in the diagnosis of squint. If one considers the type of squint, it is obvious that one will also consider the cause. If merely the degree or amount of squint is considered, the cause is still unknown, inasmuch as a squint can be of any degree and still be caused either by a mechanical or functional defect, or by a combination of both. Knowing the amount of the squint does not solve the problem of what procedure to pursue in its treatment—it tells nothing as to whether the patient has an abnormal position of the eyes at rest, due to mechanical or structural conditions; whether there is a refractive error that disturbs the relationship between accommodation and convergence, which is functional; whether the squint is associated with fusion weakness, or whether it is present only under stress and undue excitement and is a neurogenic manifestation. The amount of the squint does not indicate the methods to be used to secure fusion and stable binocular single vision as rapidly as possible, nor does it tell the ophthalmologist whether the case is one for surgery and, if so, when and what surgical methods should be attempted.

I wish to extend my grateful thanks to Dr. LeGrand H. Hardy and to my late chief, Dr. William Thornwall Davis, for helping me in listing some of the misconceptions and fictions in orthoptic training, and for the valuable counsel and stimulation they have given me.

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